

HANDBOOK OF THE TANNING TRADE OF

SOUTH INDIA.

By

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P R E F A C E

THE importance of the tanning industry to the Madras Presidency may be gauged from the fact that there are believed to be from 400 to 500 tanneries giving wholetime employment in normal times to about 20,000 hands with an estimated wage roll of about Rs. 35 lakhs per annum. Tanned hides and skins have been one of the most important exports of Madras ever since figures of sea-borne trade were published, an export trade in tanned hides and skins valued at over six crores of rupees annually having been built up. As is well known, the bulk of the skins exported are tanned but not dressed, whilst hides are usually crust tanned for export and have to be subjected to further treatment after they reach foreign markets before they can be regarded as finished leather. Reptile skins, however, in which a lucrative trade has been developed during the last ten years, are generally exported in a finished condition and do not require any subsequent treatment.

Although a number of bulletins on various aspects of the tanning industry of the Madras Presidency have been published from time to time by the department, no comprehensive account of the organization and technique of the industry has hitherto been available and the lack of any such publication has been felt by the trade. When therefore the instructional side of the Leather Trades Institute was closed down in 1930 and Major Guthrie was placed on special duty to study in detail the problem of eradicating stains on tanned hides and skins it was arranged that, in addition to the prosecution of this research, he should also undertake the preparation of a Handbook of the Tanning Trade of South India. This task he completed shortly before he left India in April.

The Handbook which embodies Major Guthrie's 21 years' experience of the Madras tanning industry is divided into two parts, the first containing information and statistics of general interest to the trade which have been extracted and brought together from a number of different publications and official records and the second part dealing with

the technique of the industry and containing a good deal of unpublished information collected by Major Guthrie during his service at the Leather Trades Institute.

It is hoped that as a result of the publication of the Handbook the magnitude and importance of the tanning industry of this Presidency will become more widely known and that the tanners and others interested in the trade will derive benefit from the information in regard to the technique of the industry given in it.

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Director of Industries.

INTRODUCTION

THIS book is the result of an order from the Government, instructing me to prepare a book on the "tanning trade" that will be of value to South Indian tanners.

After consulting a number of well-known tanners, I drew up a scheme, with a list of chapter headings, and circulated this to the trade asking for any suggestions that would improve the work. Several replies were received and wherever possible the proposals have been carried out.

In a few cases, where there is no exact English equivalent, it has been found necessary to use the Tamil expression, but wherever this is done the meaning has been explained, except in cases where it is obvious from the context.

Much of the information given has already been published elsewhere but as in many cases the publications, in which it appeared, are either out of print or not usually available, I have considered it wise to include it. The original matter is taken from notes made by me during my connexion with the trade since 1911.

The term "hides" when used refers to the outer covering of fully grown cattle and buffaloes and for customs purposes since 1919-1920, also includes those of cow and buffalo calf, whilst "skins" refers to those of goat and sheep and other small animals including reptiles. "Kip" was originally used to denote that of an animal too large to be considered a calf but not fully grown. When during the latter half of last century Indian hides began to arrive in England, they were found to correspond in size and weight to the "English kip" and hence became known as "kips" or "East Indian kips." As the number of these far out-distanced those of the local kips the term became more and more to indicate a hide of Indian origin and it is now usual to speak of an "English kip" when referring to one of English origin, whilst "kip" used alone is usually understood to refer to that from India.

I wish to thank various members of the department for help given to me in various ways and especially my assistant Mr. Subramania Sastry. I also wish to thank the Collector of Customs for kindly permitting me to examine certain records in the Custom House in order to get some of the information required for Chapter II.

A. GUTHRIE.

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Handbook of the tanning trade of South India.

PART I—GENERAL.

CHAPTER I.

History.

The ancient writings of India contain little or nothing to give any idea as to the state of the leather trade in the early days. There is however no doubt that tanning was one of the earliest industries other than agriculture that developed in India. The Rig Veda refers to the use of tanned deer skins so that it is evident that tanning was understood and carried out in India at a very early date.

Although it is impossible to say when the tanning industry of South India reached a stage where it was of more than a purely village industry there is evidence to show that there was an export trade in skins if not in tanned skins about the middle of the first century A.D. From researches made by E. H. Warmington (*The Commerce between Roman Empire and India*) it seems fairly definite that direct trade existed between the Malabar ports and Imperial Rome, and that amongst the goods sent were 'Madras tanned skins' as can be shown from the following extracts from this book. "The Periplus says that 'Chinese' hides and furs were exported from Barbarican on the river Indus and Pliny says that iron made by the 'Chinese' was sent by them with the tissues and skins to Rome, and the dyed skins obtained from the 'Chinese' were the most valuable of the coverings furnished by animals." Later on he remarks: "Now, Pliny's reference to 'Chinese' iron, tissues and skins is now taken to refer in reality to products obtained not from the "Chinese" but from the 'Chera' kingdom in South India so frequently visited by Greek merchants in the reign of Claudius onwards." The "Chera" kingdom (Kerala) consisted of the west coast from Calicut to the south and extended inland through Coimbatore to Mysore, both of which districts still produce very large number of skins and carried out a considerable amount of tanning. Previous to about 40 A.D. trade between the Roman Empire and South India had only been carried out by vessels coasting as far as Barbarican and from there along the coasts of Persia and Arabia. About this date a ship was caught by the monsoon winds near Socotra and landed on the coasts of Ceylon and from this accident a direct trade route was developed which greatly increased trade between Malabar and Rome.

The first definite evidence of export of skins from the Coromandal coast is mentioned by Moreland in his '*From Akbar to Aurangzib*.' "Up to the year 1643, I have found no record to show that skins from the Coromandal coast were carried to Japan, though small supplies were going to Batavia for local consumption. In 1644 samples of these skins which had been forwarded to Siam, were reported on favourably by a Japanese merchant engaged in the

trade of that country and from this year onwards we find the Dutch exporting regularly to Japan. The importance of the trade during our period was much less than that of silk ; I have not found figures to indicate its extent, but probably it would be measured in thousands rather than lakhs of rupees." That even a trade valued only in thousands of rupees existed points to the bulk of the trade being fairly large as the value of the skin at this time was most likely very small indeed. According to the chronicles of Farnao Nuniz which dealt with the Vijianagar Empire about 1530 A.D., the price of live sheep was only about 4 to 7 annas so that the skin must have been much less than this. " It is said that in the market they give twelve live sheep for a Pardao and in the hills they give 14 to 15 for a Pardao." The value of the Pardao has been variously estimated at 4 to 7 shillings. It is unfortunate that it is not shown whether these skins were tanned or raw, but it is of interest to note that ever since export figures are available considerable quantities of tanned skins have been sent to Japan and to Singapore for distribution in the Far East, whereas there has been little or no export of raw skins to these destinations. As early as 1875, the Straits Settlements was the next best customer to the United Kingdom for tanned skins and during the last 20 years the value of the trade in tanned sheep skins to the Straits has varied from 5 to 15 lakhs per annum. Strange to say the trade reached the higher figure during the post war slump of 1920-22.

That in Roman times skins were not the only export from India connected with the tanning trade, is shown by Warmington who says that myrabolams were an important item of trade between India and Rome. This trade seems to have been in the hands of the Arabs who acted as middle men. Whether these myrabs were exported from the south or north of India there is no evidence to show. It is however certain that by the sixteenth century myrabs were an important export from South India to Europe. Barbosa,¹ a Portuguese trader and historian, who left Portugal in 1501 for India writing of the trade of the Vijianagar Empire, which then more or less corresponded to the present Madras and Mysore, states that the chief exports through the port of Bhatkal consisted of iron, spices, drugs and myrabolams.

There is no doubt that a village tanning industry has existed in most parts of Southern India from the very early days, which supplied not only leather for local use, chiefly agricultural, but also for the military requirements of the age. Close examination of pictures depicting scenes of Tuppu Sultan's and other armies show that horses, bullocks and elephants were equipped with harness which from its appearance was apparently made of leather, and as none of the early accounts of the East India Company show leather as an important import it is evident that this must have been made locally. Whether this leather was manufactured in 'tanneries of considerable size'¹ or collected from village tanners is doubtful; but

References.

¹ Chatterton's monograph, page 3, line 9.

judging from the organization of the trade at present in parts of India where export tanneries are not as numerous as in Madras, the chances are more in favour of the village industry than of organized tanneries. In several parts of India there are still villages³ where large quantities of hides, etc., are tanned, but in which no family does more than they can do themselves, i.e., only a few hides weekly.

Little is known about the state of the trade during the first half of the nineteenth century but the records of Messrs. Parry & Co., show that their founder, Thomas Parry, started a large tannery at San Thome in the year 1805 and that within a few years of this there were from 300 to 400 workmen employed there. Leather was supplied from this tannery not only to the local cavalry regiments but exported both to America and England.

The history of the trade during the second half of the nineteenth century was carefully collected by Chatterton for his monograph written in 1905 and as no further information has since become available, I cannot do better than quote the part of his first chapter dealing with the history of this period :—

“ The European methods of tanning hides were first introduced by the military authorities who established a tannery at Hoonsur for the purpose of manufacturing superior leather suitable for harness and other military equipment. Contemporaneously, a French-Eurasian of Pondicherry named Charles de Susa introduced improvements in the native methods of preparing skins. He is said to have visited the Isle de Bourbon or Mauritius sometime in the forties and to have there acquired a practical knowledge of the French processes of tanning. On his return to Pondicherry about the end of forties he started a tannery there and a little later he came to Madras to set up several small tanneries, the products of which were probably exported to England. At that date the supply of both hides and skins was greatly in excess of the demand and from the Trade Returns of 1846 it would appear that the raw hides exported from Madras were of the average value of As. 7-8 each, whilst the raw skins were worth As. 3-2 each. These were probably selected hides and skins as the value of the exported tanned goods was even less. The tale is told that when De Susa first came to Madras he made a contract with a Muhammadan tanner to supply him with goat skins for a number of years at Rs. 14 per 100. The skin dealer thought he had made a remarkably good bargain but eventually as the result of De Susa's enterprise, the price of skins rose so rapidly that being compelled to adhere to his contract he was soon ruined. De Susa introduced many important improvements in the native processes of tanning and he was probably the first tanner in this Presidency who succeeded in producing skins which on exposure to the air showed no tendency to that fawn red discolourization

Reference.

³ Guthrie's Report on the Leather Industry of the Bombay Presidency, 1910; page 18, line 7, and Report on the Hide and Leather Industry Survey of Hyderabad State, 1931, page 16, line 6.

which was previously one of the distinguishing features of country-tanned leathers. This important improvement was effected by immersing the tanned skins in a bath of myrabolams for two or three days after the ordinary tanning had been completed. With raw materials at such an exceedingly low price, with cheap labour, and with the comparatively small capital outlay which was necessary to establish a tannery, it is not surprising that the vastly improved tanned skins found a ready market in Europe and that the export trade which he started grew rapidly to considerable dimensions. Following De Susa this new tanning trade was at first largely in the hands of Eurasians but their lack of energy, improvidence and inferior business capacity enabled Muhammadan and native tanners to cut them out, so that at the present day there is scarcely a single tannery in this Presidency worked by Eurasians."

In the Report of the Madras Exhibition of 1855 it is stated :—

"The manufacture of leather in this Presidency is by no means so thriving as it might be, considering the great abundance of tanning materials at command. This is probably owing to the very low rank of the artisans, for the art of leather production is well understood and successfully practised by European tanners in Pondicherry, Hoonsur, Guntur, Bangalore and Madras, the leather being scarcely inferior to that made in Europe. Goat skins, sheep skins, buffalo and bullock hides are much used and are generally procurable but are very badly dressed ; currying the leather being the province of the shoe-maker's wife, while manufacturing it for the market belongs to the husband. Inferiority of Indian leather may be ascribed to want of skill on the part of the currier and to the use of quicklime."

The following remarks of the Jury on class 16 which included leather, saddlery, harness, skins for feathers and hair, are also of interest :—

"The tanned hides and skins exhibited are nearly all of excellent quality and will bear comparison satisfactorily with the same kinds of leather prepared in Europe. They have been thoroughly saturated with tanning materials, are free from animal odour, and their sections do not show the white line between the outer and inner surfaces, indicative, in bad leathers, of a hasty and imperfect inhibition of the tanned liquor. The collection comprises the tanned hides of bison, sambur, bullock, horse, cow, goat, kid, dog and iguana. The last is the only kind requiring any special mention here, as all the others are well-known articles of trade and commerce. The iguana skins which have been tanned and dyed black or left of their natural colour, are thin, evens oft, tough, elastic, granular or shagreen-like in external appearance. From the absence of gloss the appearance of this leather is not much in its favour but it bids fair to be a durable article for light slippers and a good covering for the commoner kinds of instrument boxes such as are still done over with shagreen.

"*Tanned and coloured skins.*—Skins coloured and uncoloured for book binding purposes and book linings are generally even, soft and pliant and very suitable for their intended uses. Some of these

coloured leather are very brilliant. Sheep and goat skins, tanned white, are exhibited here in much perfection. None of the specimens are fine enough for the better kinds of gloves but they are all as well-suited as European skins of the kind for the purpose of the apothecary.

“ *Wash leather.*—The skins prepared with oil in imitation of chamois or wash leather are all excellent specimens of the kind so far as thickness, softness, pliance and colour are concerned. In all these respects they will bear comparison with the European article, but as every one of these leathers is tainted with the odour of the fish oil employed in their preparation they cannot be recommended for household purposes such as cleaning plate, though they will be found very suitable for cleaning brasses and harness.”

A second Industrial Exhibition was held in Madras only two years later and the Jury on leather then reported as follows :—

“ At a moment when the manufactures of this Presidency are in a transition state, passing from the old unaided manual labour system to all the great advantages conferred by the introduction of steam machinery it seems imperative that one of the most important should not be overlooked. The manufacture of leather in this Presidency, whether regarded with reference to the requirements of the public service or from a commercial point of view, is scarcely second to any other manufacture, either in extent or importance. But, before entering on the question of tanning, it may not be uninteresting or unimportant to submit a brief sketch of the exports of hides and tanning substances, shipped at Madras for the last three years. Commencing with the years 1853–54, the number of untanned hides exported chiefly to England, Holland and France was 236,876 with a money value of Rs. 1,33,295; in the years 1854–55 there were shipments of 2,495,465 hides with a value of Rs. 6,42,035; and in 1855–56 the exports were 1,238,079 hides valued at Rs. 3,71,736; exhibiting a total number of hides, exported during the last 3½ years, of no fewer than 6,003,086 of the estimated value of Rs. 24,71,379. It has been before observed that the largest exports have been made to England, Holland and France, and to these may be added, Arabia, the Persian Gulf, the Indian French ports, Sind; and strange as it may appear, to Bengal for re-shipment to North America. Looking into these facts it is unquestionable that this Presidency possesses within itself the most ample means for meeting its requirements so far as the supply of raw hides is involved; and in concluding these remarks one very striking fact may be added, that the declared value of the hides exported from Madras during the month of February last (1857) reached the very large amount of Rs. 2,04,996.

“ From the same report we learn that the Jury of 1857 did not take so favourable a view of the condition of the industry as was done at the previous exhibition, for they state that ‘ of the tanned hides and skins exhibited, although several of the specimens are of a very satisfactory quality, it is unquestionable that the manufacture of leather in the Presidency is till capable of great improvement and development.’ At that date the leading tannery in the Presidency appears

to have been maintained by the military authorities at Hoonsur, closely followed however by the Horse Artillery tannery at Bangalore and the Bodyguard Pits in Madras. A list of the exhibitors who obtained awards at one or other of these two exhibitions, includes probably all the more important tanners in the Presidency and amongst them we find the names of Mr. Crowe of Madras, Narasingadu of Ellore, Kullappa of Bellary, Rungacharlu of Saidapet, Chingleput and Pallavaram, Veeraswami Mudaliyar of Palghat, Meerapillai Labbai of Chingleput and Kasi Rao of Salem.

“ I have been unable to trace in detail the subsequent history of the leather trade in this Presidency. But from the information given in the statistical tables appended to this chapter it will be seen that the industry continued to steadily develop till nearly the middle of the seventies, when various causes operating at the same time led to a very rapid expansion. Up till that date the skins were consigned to dealers in England who disposed off them privately, but then, a change was made and public auctions were established. The conclusion of the Franco-Prussian war was followed by great activity on the part of Germany and about 1875 German tanners commenced buying East Indian skins in large quantities. Further in August of that year the export duty of 3 per cent on skins was repealed ; and followed, as this was, almost immediately by the great famine of 1876-77, which was attended with immense mortality among the livestock, an enormous expansion in the export trade in hides and skins took place and has ever since been maintained. Lastly, and perhaps of the greatest importance, was the completion of the main trunk lines of railways which enabled the Madras tanners to obtain supplies of raw materials from greatly extended areas.”

From the statistics and graphs given in the following chapter it will be seen that the export trade in hides and skins in Madras is pre-eminently one of the tanned product whereas all other centres in India export raw goods with the exception of Bombay which exports considerable quantities of both raw and tanned.

Chatterton on page 6 of his monograph states “ It must be remembered that large as the Madras business is in hides and skins that of Calcutta is much greater and nearly the whole of the Bengal trade has always been in raw hides and skins.” The first part of this statement continued to be true until the war when the Calcutta's pride of place was lost to Madras. In 1912-13 the total exports of hides and skins from Calcutta amounted to about 8 crores as against 4 crores from Madras. In 1928-29 Madras exported $8\frac{1}{2}$ crores as against Calcutta figure of under $5\frac{3}{4}$ crores. It is however still correct that the exports of Calcutta are almost all of raw material while those of Madras are almost all tanned. Graph No. 9 in the following chapter shows how this change has taken place.

The outstanding landmarks of the Madras trade may be considered to be—

- (1) The introduction of improvements in tanning methods by Charles de Susa.

- (2) The opening of a military tannery at Hoonsur (both between 1840 and 1850).
- (3) The abolition of the export duty of 3 per cent *advalorem* on tanned hides and skin in 1875 that had been collected from 1859.
- (4) The introduction of chrome tanned glace kids in America and Europe about the end of the last century and the consequent greatly increased demand for raw goat skins for export which developed about 1898 and the subsequent falling off of supplies to the Madras tanner.
- (5) The control exercised by Government during the war period in 1917-19 and the stoppage of tannage of skins and the practice of plastering the flesh of hides.
- (6) The introduction in 1919 of 15 per cent export duty on raw hides and skins with a rebate of 10 per cent on goods tanned within the British Empire.
- (7) The reduction of this export duty to 5 per cent in March 1923.
- (8) The introduction of imported wattle bark to supplement supplies of avaram and the steady increase in the use of this material until in 1928 practically all hides exported were tanned with it.
- (9) Agitation, chiefly in Northern India, for the repeal of the 5 per cent export duty and the counter one for its increase chiefly in Southern India, leading to the appointment of the Hides Cess Enquiry Committee in 1929.
- (10) The ever-increasing tariff barriers raised in many countries in order to encourage the importation of raw hides and skins rather than tanned one. These culminated in the American tariff of 1930 which caused an immediate cessation of direct shipments to the United States of America and also greatly decreased the demand for certain classes of tanned hides from English curriers who had previously been exporting large quantities of lining leathers made from Madras kips to America.

CHAPTER II.

Statistics.

Although there has never been a census of production of the tanning trade of South India much more can be learned regarding its size and importance from a study of the export figures than can be done in most other trades, as for many years the trade has been primarily one of production for export.

The first actual customs figures I have been able to find are those given in Chatterton's Monograph for the port of Fort St. George, for the year 1846-47. These are given in Table I.

Table I.

Exports by sea from Fort St. George during 1846-47.

Foreign ports.

(1)	Foreign ports.							
	United Kingdom.		America.		Other foreign ports.		Total	
	(2)		(3)		(4)		(5)	
	NO.	RS.	NO.	RS.	NO.	RS.	NO.	RS.
Raw hides	48,212	22,483	...	...	386	425	48,598	22,908
Raw skins	67,845	8,545	157,500	31,500	2,490	265	227,835	40,310
Hides and leather	9,358	4,797	...	...	4,807	1,110	14,165	5,907
Skins, tanned ... ..	...	...	...	...	13,838	1,459	13,838	1,459

Home ports.

(1)	Home ports.							
	Bengal.		Other home ports.		Total.		Grand total.	
	(6)		(7)		(8)		(9)	
	NO.	RS.	NO.	RS.	NO.	RS.	NO.	RS.
Raw hides	1,860	1,326	1,454	600	3,314	1,926	51,912	24,834
Raw skins	916,946	1,84,382	6,500	700	923,446	1,85,082	1,151,281	2,25,392
Hides and leather	1,088	218	553	235	1,641	453	15,806	6,360
Skins, tanned	87,441	9,808	71,310	7,308	158,751	17,116	172,589	18,575

Table II.

Statement showing the quantity and value of hides and skins exported to foreign ports from the Madras Presidency.

Years.	Number in thousands.	Value in thousands.
1855-56	...	...
1856-57	...	...
1857-58	...	...
1858-59	...	...
1859-60	...	...
1860-61	...	...
1861-62	...	...
1862-63	2,809	1,210
1863-64	3,379	1,478
1864-65	3,527	1,569
1865-66	3,470	1,512
1866-67	4,052	1,920
1867-68	4,536	2,557
1868-69	4,846	2,580
1869-70	5,619	3,081
1870-71	5,658	3,144
1871-72	7,063	3,999
1872-73	8,390	5,239
1873-74	8,256	5,277
1874-75	6,615	4,445
1875-76	8,987	10,084
1876-77	9,827	11,898

* For eleven months only.

Note.—I have been unable to find any satisfactory explanation for the enormous increase in value of hides and skins which took place in 1875-76. The increase is almost 100 per cent; and though the reasons stated on page 6 powerfully operated to raise prices, I am inclined to think that the sudden change is due in part to a different method of estimating values having been adopted when the export duty was abolished.

These figures are extremely interesting in that they show that (1) the chief exports were of raw hides and skins which were valued at roughly ten times the amount of tanned goods, and (2) that three-fourths of the goods exported went to other parts of India. The total exports to foreign countries were then under three-fourths lakh, but as can be seen from Table II, also taken from Chatterton's Monograph, this had increased to 12 lakhs (for the whole Presidency) by 1862-63 and reached over a crore in 1875-76.

During that year raw goods only accounted for about 2½ lakhs and were almost entirely from ports like Mangalore and Bimlipatam which were then not connected with Madras by rail. There were no exports whatever of raw hides from the chief port.

Like Chatterton I have been unable satisfactorily to account for the immense increase in the value of goods exported in 1875-76 compared to 1874-75. In the earlier year the average value of the tanned skins exported was As. 8 and of the tanned hides Rs. 2-8-0 whilst in the following year values had increased to about As. 14 and about Rs. 3-8-0 respectively. The proportion of hides to skins remain just about the same. It is possible, however, that in

Table III.

Statement showing the total value of the trade of the Madras Presidency in hides and skins.

Number in thousands.	Value in thousands.
2,522	753
3,412	1,387
4,276	2,206
4,656	1,765
4,283	1,551
3,868	1,653
3,108	1,368
4,200	1,885
4,469	2,062
4,278	1,939
4,443	1,981
4,869	2,359
5,158	2,898
5,925	3,174
6,559	3,649
7,120	4,093
8,360	4,725
10,840	6,667
9,524	6,197
7,981	5,626
9,909	10,815
11,316	12,946

order to simplify the collection of the export tax of 3 per cent on tanned hides and skins that Government had fixed a tariff value for these goods, in the same way that is now done to collect the 5 per cent export duty on raw hides and skins and that during 1874-75 this had been fixed at Rs. 2-8-0 and As. 8. It may be a coincidence but in no other year where I have worked out the average values have the figures been exactly round figure in both cases as they were this year. During the period April to August 1875-76 goods were still taxed and values worked out at Rs. 3-4-0 and As. 13½ whereas for the rest of the year they worked out about Rs. 3-9-0 and about As. 16 (Table IV). This looks as if there had been a quickly rising market during 1874-76 due to trade boom following the Franco-Prussian War, and that as tariff values were only changed yearly the increased values did not show in 1874-75. In this connection it is interesting to note that America became a buyer of tanned skins in 1876-77 taking just over half a lakh worth. After this date direct trade to America in tanned skins continued and increased very considerably until it reached a maximum in 1892-93 after which it fell off considerably and was replaced by a demand for raw goat skins due to the introduction of chrome tanned glacé kid which replaced combination tanned leather made from Madras tanned skin which had previously been used.

That Madras still carried on a certain amount of trade with other parts of India in addition to that of foreign ports can be seen by comparing the total values shown in Table III and Table II which have been placed alongside one another so as to facilitate comparison.

Table IV.

Export from the Madras Presidency to foreign ports.

Years.	Raw hides.			Tanned hides.			Raw skins.			Tanned skins.		
	Weight in 100 of cwt.	Number in 1,000.	Value in 1,000.	Weight in 100 of cwt.	Number in 1,000.	Value in 1,000.	Weight in 100 of cwt.	Number in 1,000.	Value in 1,000.	Weight in 100 of cwt.	Number in 1,000.	Value in 1,000.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
			Rs.			Rs.			Rs.			Rs.
1875-76 taxed.	...	...	...	170	241	781	...	...	...	266	3,037	2,470
Non-taxed	108	130	240	205	446	1,585	5	22	16	438	5,103	4,083
1876-77	68	83	101	748	1,180	4,031	4	22	20	750	8,833	7,746
1877-78	95	134	172	1,301	2,158	7,222	4	42	26	711	8,502	7,240
1878-79	12	18	19	449	715	2,211	4	25	24	718	8,032	7,716
1879-80	7	10	13	202	647	1,411	9	56	64	821	9,001	9,109
1880-81	17	31	53	500	720	2,737	6	43	43	880	10,013	10,045
1881-82	21	31	63	608	918	3,341	6	27	41	1,045	11,586	11,687
1882-83	11	19	40	758	1,066	4,102	6	36	54	1,178	12,017	14,204
1883-84	11	17	32	688	1,005	3,818	6	35	50	1,125	12,786	12,573
1884-85	20	46	86	786	1,108	4,374	6	33	45	1,010	11,577	11,430
1885-86	18	26	52	100	1,001	4,218	2	16	21	1,247	13,959	14,110
1886-87	1	3	5	631	900	3,569	3	19	29	1,320	14,495	14,704
1887-88	7	7	18	908	131	5,045	4	20	24	1,385	15,774	15,619
1888-89	4	5	11	868	1,255	4,702	4	27	33	1,421	16,653	16,350
1889-90	...	1	1	812	1,148	4,438	6	32	54	1,350	16,016	15,740
1890-91	3	5	9	874	1,096	4,217	10	54	60	1,397	15,647	15,780
1891-92	...	3	2	935	1,406	5,025	8	30	59	1,476	16,783	16,725
1892-93	...	...	...	1,015	1,609	5,604	11	38	77	1,498	18,571	18,483
1893-94	...	...	1	648	908	3,576	8	29	57	1,576	17,316	22,500
1894-95	1	1	2	860	1,360	4,824	8	24	52	1,700	19,443	25,767
1895-96	2	2	6	1,258	1,930	7,087	11	31	60	1,722	20,743	26,064
1896-97	1	1	5	1,185	1,780	6,624	5	22	30	1,645	17,867	23,063
1897-98	1	1	5	1,351	2,243	8,665	3	26	15	1,561	20,843	22,376
1898-99	...	1	4	1,094	1,763	6,084	65	370	460	1,327	14,050	10,843
1899-1900	...	...	1	1,141	1,876	6,756	215	1,226	1,023	1,403	15,958	20,587
1900-01	1	1	3	2,107	3,474	12,309	266	1,572	2,010	1,660	17,809	22,452
1901-02	20	20	93	1,204	1,955	6,604	640	4,028	5,900	1,005	11,022	14,011

Table IV shows exports of raw and tanned hides and skins to foreign ports from the Madras Presidency from 1874 to 1902. A study of the report of the sea-borne trade of the Presidency during this period shows that during the seventies and eighties the export trade of the Madras Presidency in hides and skins was normally higher in value than that of any other class of merchandise. It however fell in certain years to second place as for example to coffee in 1878-79 and to cotton in 1889-90.

The imports of raw hides and skins by sea from other parts of India with the exception of Calcutta were always negligible. Even from Calcutta they were so until 1880-81 when the trade in raw skins reached about one lakh in value. This trade continued to increase until 1893 to 1896 when it averaged about seven lakhs per annum but immediately after this fell quickly again till it was only two lakhs two years later. It was just at this time that the American demand for raw goat skins for chrome tannage developed and there is no doubt that this fall in values was due to this cause. (See Table IV.)

During the whole of this period America took considerable amount of tanned skins amounting in 1892-93 to Rs. 58 lakhs or over 30 per cent of the exports of tanned skins.

Table V.

(Weight in 100 cwt.)

Statement showing exports of different classes of tanned hides and skins from Madras Presidency.

Year.	Buffalo hides.	Cow hides.	Buffalo calf.	Cow calf.	Total, hides.	Goat skins.	Sheep skins.	Other skins.	Total, skins.	Total, hides and skins.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1901-2	...	...	...	...	120.4	...	...	...	100.4	...
1902-3	...	...	...	...	97.0	...	...	...	111.2	214.3
1903-4	...	...	...	...	93.9	...	...	...	124.9	218.8
1904-5	...	...	...	...	112.5	...	...	...	101.6	214.0
1905-6	...	...	...	...	177.7	48.1	48.3	4.2	100.7	278.4
1906-7	...	...	...	...	197.5	52.6	52.2	4.6	109.4	306.9
1907-8	...	...	...	...	114.0	50.6	55.3	2.4	108.3	222.3
1908-9	...	...	...	...	144.8	54.4	55.5	4.3	114.2	259.0
1909-10	...	...	...	...	151.3	47.9	53.7	4.3	105.9	257.2
1910-11	...	...	...	...	124.5	58.3	54.4	4.0	116.8	241.3
1911-12	...	...	...	...	150.2	64.6	54.7	7.5	126.8	277.0
1912-13	14.7	177.5	...	...	192.2	47.7	52.8	7.5	108.0	300.2
1913-14	14.1	128.3	...	...	142.4	59.4	44.4	6.8	110.5	252.9
1914-15	22.2	148.0	...	...	170.3	47.6	39.8	10.1	97.5	267.8
1915-16	23.5	198.9	...	...	222.4	57.0	40.8	7.2	105.1	327.5
1916-17	30.4	244.2	...	...	274.6	68.6	51.9	12.5	133.0	407.6
1917-18	17.8	283.1	...	...	300.8	3.7	6.6	5.9	16.2	317.0
1918-19	7.5	443.0	...	...	450.5	6.5	12.7	7.3	26.6	477.1
1919-20	29.5	332.6	3.1	9.8	375.0	25.3	56.8	...	82.2	557.2
(Weight in tons.)										
1920-21	197	2,778	60	232	3,258	691	1,677	...	2,368	5,626
1921-22	360	3,784	49	248	4,442	1,007	2,516	26	3,523	7,965
1922-23	598	6,792	175	510	8,075	1,156	2,860	7	4,016	12,091
1923-24	744	9,569	162	652	11,127	997	3,287	1	4,285	15,412
1924-25	797	9,276	214	570	10,875	2,504	2,783	9	5,287	16,144
1925-26	377	9,147	287	600	10,411	2,490	3,083	8	5,523	15,934
1926-27	382	8,515	262	611	9,770	3,051	3,014	5	6,070	15,840
1927-28	1,042	11,609	494	750	13,877	3,199	3,123	39	6,361	20,238
1928-29	1,293	12,327	573	659	14,854	3,072	2,941	82	6,095	20,947
1929-30	1,009	10,708	530	599	12,846	2,674	3,001	74	5,749	18,595
1930-31	605	9,236	386	500	10,727	2,779	2,678	34	5,491	16,218
1931-32	555	8,305	304	448	9,612	2,394	2,501	53	4,948	14,560

Table VI.

(Number in 1,000.)

Statement showing export of different classes of tanned hides and skins from Madras Presidency.

Year.	Buffalo hides.	Cow hides.	Buffalo calf.	Cow calf.	Total, hides.	Goat skins.	Sheep skins.	Other skins.	Total, skins.	Total, hides and skins.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1901-2	1,955	...	...	...	11,922	...
1902-3	1,559	...	...	...	13,883	15,443
1903-4	1,453	...	...	...	14,519	15,972
1904-5	1,715	...	...	...	11,710	13,425
1905-6	2,668	5,323	7,041	237	12,602	15,271
1906-7	2,941	5,972	7,770	266	14,008	16,950
1907-8	1,691	5,620	8,318	146	14,085	15,775
1908-9	2,195	6,068	8,414	244	14,726	16,921
1909-10	2,173	5,118	8,110	228	13,456	15,628
1910-11	1,716	6,616	8,437	228	15,282	16,997
1911-12	2,004	7,420	8,783	492	16,695	18,789
1912-13	...	157	2,581	...	2,738	5,523	8,771	453	14,746	17,484
1913-14	...	154	1,751	...	1,906	7,055	7,507	435	14,997	16,903
1914-15	...	239	2,079	...	2,318	5,938	6,759	737	13,434	15,782
1915-16	...	262	2,791	...	3,054	6,995	7,063	476	14,535	17,589
1916-17	...	319	3,256	...	3,636	8,607	9,000	761	18,367	22,003
1917-18	...	200	3,888	...	4,088	552	1,336	401	2,289	6,377
1918-19	...	92	6,249	...	6,341	923	2,335	519	3,777	10,118
1919-20	...	292	4,673	180	5,820	3,945	10,190	...	14,135	19,955
1920-21	...	40	800	73	1,280	1,996	6,648	1	8,645	19,925
1921-22	...	72	1,158	59	1,683	2,772	9,776	4	12,552	14,235
1922-23	...	131	2,077	206	3,175	3,105	10,139	2	13,247	16,422
1923-24	...	170	2,867	192	4,158	2,747	12,251	5	15,004	19,162
1924-25	...	171	2,787	268	4,092	7,318	11,133	1	18,454	22,546
1925-26	...	83	2,750	344	4,151	7,953	11,945	9	19,907	24,058
1926-27	...	86	2,740	317	4,108	9,787	11,857	113	4,758	25,866
1927-28	...	234	3,642	614	5,214	10,197	12,748	564	23,510	29,216
1928-29	...	289	3,839	665	5,818	10,346	11,374	1,156	22,878	28,696
1929-30	...	229	3,616	597	5,343	9,170	11,875	1,121	22,167	27,510
1930-31	...	157	3,094	427	4,387	7,948	10,990	431	19,367	23,754
1931-32	...	129	2,785	341	3,792	8,331	9,402	737	18,471	22,263

Table VII.

(Value in thousands of rupees.)

Statement showing exports of different classes of tanned hides and skins from Madras Presidency.

Year.	Buff hides.	Cow hides.	Buff calf.	Cow calf.	Total hides.	Goat skins.	Sheep skins.	Other skins.	Total skins.	Total hides and skins.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1901-2	...	...	...	...	66,94	...	...	...	1,42,11	...
1902-3	...	...	...	...	54,55	...	...	...	1,70,49	2,31,03
1903-4	...	...	...	...	54,81	...	...	...	1,80,34	2,44,15
1904-5	...	...	...	...	74,18	...	...	...	1,44,86	2,19,04
1905-6	...	...	...	...	1,33,59	82,79	63,44	3,99	1,50,21	2,83,81
1906-7	...	...	...	...	1,51,98	1,07,35	96,85	4,11	2,08,32	3,60,29
1907-8	...	...	...	...	88,47	1,07,02	1,06,96	2,16	2,16,14	3,04,61
1908-9	...	...	...	...	1,12,22	1,15,55	1,08,01	3,96	2,27,52	3,39,74
1909-10	...	...	...	...	1,15,16	1,02,47	1,02,66	3,65	2,08,78	3,28,94
1910-11	...	...	...	...	96,53	1,29,96	1,04,24	3,78	2,37,99	3,34,51
1911-12	...	...	...	...	1,20,13	1,43,04	1,05,11	6,88	2,55,03	3,75,16
1912-13	9,80	1,50,46	...	...	1,60,27	1,05,56	1,02,87	7,26	2,15,69	3,75,96
1913-14	9,93	1,13,31	...	...	1,23,25	1,31,19	85,70	6,83	2,23,71	3,46,96
1914-15	19,88	1,60,00	...	...	1,79,88	1,02,64	75,21	12,03	1,89,88	3,78,76
1915-16	20,98	2,15,60	...	...	2,36,58	1,22,00	81,48	8,04	2,11,51	5,48,09
1916-17	33,94	3,29,70 *	...	...	3,63,70 *	2,12,35	1,65,96	19,16	3,97,47	7,61,17
1917-18	17,93	2,95,10 *	...	...	4,13,04 *	25,86	31,86	7,91 *	65,65 *	4,78,69
1918-19	6,23	6,40,38	...	...	6,46,63	31,93	36,00	10,41	98,34	7,44,97
1919-20	32,02	4,97,01	5,24	25,15	5,59,43	1,51,49	2,57,69	...	4,09,18	9,68,61
1920-21	3,74	71,39	2,15	9,03	86,33	64,35	1,16,26	3	1,80,64	2,66,97
1921-22	4,75	72,67	94	6,25	84,64	71,32	1,42,09	4	2,13,47	2,98,11
1922-23	9,84	1,41,69	3,51	14,95	1,70,01	88,06	1,51,22	2	2,39,31	4,09,32
1923-24	11,97	2,13,81	3,29	19,87	2,48,97	65,86	1,75,30	6	2,41,22	4,90,19
1924-25	15,10	2,15,66	5,34	22,16	2,58,28	1,70,04	1,61,53	4	2,31,61	5,89,89
1925-26	7,41	2,12,82	7,62	21,91	2,49,76	1,68,78	1,81,62	9	3,50,50	6,00,26
1926-27	7,07	1,93,00	8,23	23,20	2,31,52	2,09,79	1,94,43	2,12	4,06,34	6,37,86
1927-28	20,56	2,83,50	14,17	30,01	3,48,26	2,23,82	1,95,58	10,80	4,30,21	7,78,47
1928-29	27,29	3,14,20	17,67	26,27	3,85,46	2,17,75	1,83,56	20,91	4,22,23	8,07,69
1929-30	19,86	2,41,37	15,19	22,45	2,98,90	1,91,90	1,79,20	19,42	3,90,54	6,89,44
1930-31	11,14	2,01,45	9,51	14,62	2,36,75	1,57,35	1,57,93	6,32	3,21,65	5,58,40
1931-32	9,60	1,66,03	6,33	12,78	1,94,76	1,50,96	1,24,82	5,74	2,81,53	4,76,29

* Entirely or partly shown as Government stores.

These tables give the weight, number and value of tanned hides and skins shipped from Madras to foreign ports from 1901 to 1932. The study of masses of figures like these is exceedingly difficult and hence they have been put into graph form which permits of easier study. Graphs showing several other items of interest have also been prepared.—Vide Appendix in the end.

Graph I.—This shows the course of the export trade on tanned hides from 1875 to the present date. In 1919–20 tanned cow and buffaloe calves which previously had been shown under the head tanned skins were included as hides so that from this date there should be a considerable increase in numbers compared with weight. This should also tend to show a considerably lessened average weight.

Most of the apexes in the first half of the graph are due to famines in some parts of India and to the consequent increased mortality amongst cattle, those of 1877–78, 1897–98 and 1900–01 being the most prominent. Later on the very high summit of 1918–19 and the ascent leading to it was due to the war demands for tanned hides. The apex of 1928–29 was due to combination of causes (1) a shortage of leather in all parts of the world, (2) the poorer economic condition of countries usually buying raw goods compared to those buying tanned goods, i.e., Germany to England, (3) the export duty on raw hides and skins, (4) the possibility of tanning more hides due to the importation of wattle bark. Depressions have been due usually to either the decreased availability of raw hides after periods of famine or the lack of demand on account of trade depression often following wars; examples of the first type are 1879–80, 1898–99 and 1902–04, whereas 1920–22 and 1932 are example of the second kind.

The two most noticeable tendencies during the whole period has been the greater relative increase in numbers and values than in weight. There are several reasons for both of these (1) until the last three years there has been an irregular but pronounced increase in leather values, (2) owing to greater demand for lighter weights of hides at higher prices and to the inclusion of calf skins under the heading "hides" the average weight of the hides exported has decreased, (3) the sale of finished leathers is now almost entirely by area and not by weight so that demand for lighter weighing leathers has increased, (4) the discontinuing of the application of plaster of grease, flour and other weighting materials to the flesh side of hides which was normal until the war control period, when it was prohibited, since then it has not been re-started, (5) the much greater use now being made of heavier hides for use in India due to the increased wearing of shoes.

Graph II.—This shows export of tanned skins from 1875 to the present day. This includes goat and sheep skins throughout the whole period and calf both cow and buff up to 1919–20 when they were recorded separately and transferred to the heading tanned hides. Other skins such as reptiles were also included under this head, but would make no perceptible difference except in 1927–29.

The most noticeable point is the fairly steady rise to the highest weight apex in 1894-96 which was due to increasing demand from England and America and to the increased availability of raw goods owing to the opening up of India by railways. The fall after this was undoubtedly due to the increased demand for raw goat skins from America and Europe on account of the introduction of the chrome tanning process.* The second apex in 1900-01 was most likely caused by the great famine in Northern India which was naturally followed by a very low point. It is of interest to note however that the famines of 1877-78 and 1897-98 showed no increase in export of skins although there was a very large one in hides. The price apexes of 1916 and 1919 were due to war conditions and the depression between them was due to the prohibition of tannage and export in order to conserve avaram bark for the tannage of hides. The depression of 1920-22 is due to the post war slump. The very high price and number apexes of 1927-28 which corresponds with the much less noticeable weight apex shows that skins of much less weight were being exported from Madras at that time than during the nineties. This was due to the following reasons :—

- (1) The proportion of goat to sheep tanned was greater in the nineties than later on and goat skins weigh considerably more than do sheep ;
- (2) many more skins of common oily and fleshy type were exported at the earlier date, whilst later on skins of prime and middle class tannage have been the bulk and these on account of better fleshing, etc., weigh much less ;
- (3) the goat skins exported in 1927-28 were of lighter type as most of the heavies were then being exported raw for chrome tanning abroad.

Graphs III and IV.—These two graphs show the export of tanned goat and sheep respectively from 1905 to 1906 when they were first recorded separately. The most noticeable difference between the two graphs is that the yearly variations in the goat graph are much greater and more noticeable than those in the sheep graph. This is due to the fact that supplies of raw goat skins available for the South Indian tanner depends not only on the number of animals slaughtered in India but also on account of the demand for raw skins for export varying, more or less, inversely as this demand. A great majority of the skins tanned by the Madras tanner are those rejected by the raw export trade. The large fall in the export of tanned sheep skins in the year 1913-14 is difficult to explain as there was no increase in the export of raw sheep skins and no other explanation for small supplies of raw goods.

The reasons for the variations during the war period have been dealt with in graph 2, but it is of special interest to note that the 1921 depression affected sheep skins much less severely than it did

Reference.

* Monograph on Tanning and Working in Leather in the Madras Presidency—Chatterton, pages 44 and 45.

goat, and that sheep skins recovered much quicker than did goat. From 1922 to 1929 there was little difference in the export of tanned sheep but goat varied very considerably. Since that time the trade depression and the falling values has not only made less demand for tanned skins from abroad but has made the supply of raw skins considerably less as the people of India especially the agriculturists have been able to spend less money on food and hence have eaten less meat.

Graph V.—This small graph of the export of tanned reptile skins shows the extraordinary rise from nothing to over 20 lakhs in value in the five years and of the fall to about one-third of this value in the following two years. The rise shown in this graph is actually much less than did take place as large quantities of these goods were exported by parcel post, which is shown under a separate heading, in which different classes of goods are not divided. This is a good example of how “ Dame Fashion ” can affect commerce.

Graph VI.—Shows the export of raw skins from Madras. It can be seen that with the exception of the years when tannage of skins was prohibited and a few years following that, the export of raw sheep has always been negligible. It may be noticed that most of the various apexes during the pre-war period in the exports of raw goat coincide with the depression in Graph III, that is, in tanned goat skins. The sheep apex of 1819 and the goat one of the following year are no doubt accounted for by the prohibition of tannage during 1917 and to the stocks of skins collected during that period. The freeing of shipping from control was also an additional factor.

Graph VII.—Shows the export of myrabolams from Madras Presidency. These were mostly from the Northern ports such as Bimlipatam. During the war there was very little shipping available for these ports with the result that the direction of export was deflected to Bombay and Calcutta, especially as about that time much better railway facilities became available. Madras has not recovered this trade since the war and it is unlikely to do so. Most of this trade was from the ports of Bimlipatam and Calingapatam. The trade of the former has decreased very considerably whilst the latter is no longer a recognized port.

Graph VIII.—This graph shows how Madras holds pride of place amongst the Presidencies in the export of tanned hides and skins from India but it exports relatively very little of raw goods.

Graph IX.—This graph shows relative value of the total export trade of the different Presidencies of India in hides and skins, both raw and tanned. It shows how Madras has gradually replaced Bengal as the chief exporting centre and how Bombay, Sind and Burma have kept about the same position except during the war period when Bombay improved its position due to the greater availability of shipping and the increased tannage of hides for War Office purposes. At one time during the control period a considerable quantity of Madras tanned hides were sent by rail to Bombay for export as no shipping was available from Madras.

Graph X.—This graph is intended to show how the imports of wattle bark increased till 1928–29 when it reached practically the same level as the export of tanned hides which may be considered the saturation point. As explained in Chapter VIII (wattle bark) it is unlikely under present conditions that imports of wattle bark will ever be much greater than the exports of tanned hides as the tanner who uses wattle bark only uses about 1 to 1½ pounds of wattle bark for each pound of leather produced and many tanners still use a small proportion of local barks either avaram or konam to improve the quality of the leather.

Graph XI.—This graph differs from all the preceding ones in that it is an all-India graph. It shows how the tendency for the last 25 years has been irregularly but surely tending to a greater proportion of the hides and skins available for export to be exported tanned rather than in the untanned condition. As South India is the great exporter of tanned goods it shows as does graph IX that the chief exporting centre has travelled South.

Graphs XII and XIII.—These show the bulk and value of the inter-Provincial trade in different classes of raw goods from Burma to Madras. Madras has bought roughly 40 times as many raw hides and skins from Burma as have foreign countries. Goat skins and cow hides are of almost equal importance, the imports of buff hides and sheep skins always being much less.

Graphs XIV, XV and XVI.—These graphs show the proportion of tanned sheep, goat and hides exported to different countries. The most noticeable feature is that direct exports to any other country than the United Kingdom are relatively quite small except in the case of tanned sheep skins where before the war America took considerable quantity and since the war Japan has taken second place. The effect of the American Tariff of 1930 is shown by the almost complete stoppage of direct shipment after this date.

These graphs must not be taken to mean that the United Kingdom uses all the hides and skins sent there, as in some cases there is a considerable re-export. This is especially so in the case of tanned goat of which there is a very large re-export from the United Kingdom amounting in 1930 to about 60 per cent * of the amount imported. These re-exports go chiefly to the continent of Europe, especially to Germany, but a certain quantity goes to America and elsewhere. The proportion of tanned sheep skins re-exported from the United Kingdom is much less being only 20 per cent * and for tanned hides being under 10 per cent.* In addition to the immediate re-export, there is, in many cases, a further export from England after the goods have been further treated. In the case of hides this was very large before 1930 as America took very large quantities of lining sides which were made from Madras tanned kips.

Graphs XVII and XVIII.—These show the declared value of different classes of tanned hides and skins since they were separately recorded. The figures for skins do not vary as much as those for

References.

* The Leather Trades Year Book, 1931, page 298.

hides which I think may be accounted for as the declared price for skins is rather an estimate of value than actual value. Skins as will be explained later (Chapter XIII) are usually sent to the United Kingdom on commission sales to the public auctions and hence the value that they will fetch is not known when they are exported. The hides are much oftener exported C.I.F. so that the price is in their case accurately known.

Graph XIX.—Shows weekly prices of avaram bark from January 1922 to July 1927.*

Graph XX.—Is a combination of the various lines of the above graphs and shows average value each week of the year during the same period.

Graphs XXI and XXII.—These show the export of tanned buff and cow calf skins since they were separately recorded and for "other tanned skins" which were almost entirely calf before that date. The rapid rise in the amount of trade after war is the most noticeable feature of these graphs. From the time they were separately recorded they have been included under the chief heading hides, but before that date were included under skins.

Diagram 23 shows at a glance the relative number of cattle, buffaloes, sheep and goat that are in South India compared with the whole of India. The figures† for all India are a little low as a certain number of Indian States do not take any cattle census, whilst figures for South India are complete. As these figures are of importance to the leather trade they are given also in the form of a table.

Table VIII.

	Numbers in thousands.			
	Cattle.	Bufs.	Sheep.	Goat.
South India—				
Madras Presidency	16,447	5,994	12,864	7,406
Hyderabad	9,652	4,102	5,744	3,054
Mysore	4,050	843	2,821	1,594
Madras States	1,331	182	492	214
Total, South India ...	31,480	11,121	21,921	12,268
All-India—				
British India	122,985	31,645	25,540	35,943
Indian States	33,829	9,378	16,259	12,381
Total, All-India ...	156,814	41,023	41,799	48,324

The most interesting feature of this diagram and of these figures is that whereas Madras and the neighbouring States have only about one-fifth of the cattle population of India and one-fourth of the buffaloes and goats they have over half of the sheep. If we take the figures of the average length of life of sheep and goat as

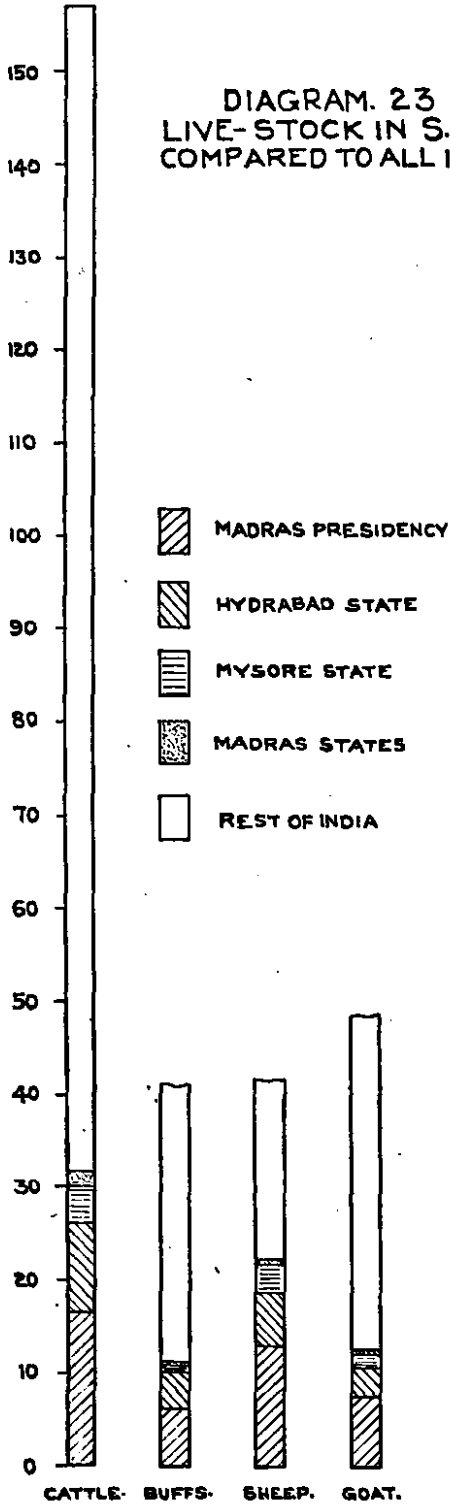
References.

* Hide Cess Inquiry Committee Report, volume 1, page 231 (originally supplied by Messrs. Best & Co.).

† India—Livestock Statistics, 1929-30.

MILLION
160

DIAGRAM. 23
LIVE-STOCK IN S.INDIA
COMPARED TO ALL INDIA



must under three and three and a half years, respectively—as was estimated by a livestock expert before the Hide Cess Enquiry Committee—it follows that South India should produce about seven million sheep skins and three and a half million goat skins. As there is little demand for these skins for local use practically the whole are available for export and almost the whole of the sheep skins are tanned by export tanners whilst the goat skins are either exported raw or after tannage.

As very few cattle are slaughtered for food in South India and considerably less in proportion to North India, where beef is eaten by most of the Muhammadan population, it is likely that the average life of cattle is longer in South India than for India as a whole. If we estimate them as six or eight years for South India, we get a hide supply of five or four millions. As the use of hides in the districts is considerable, though in quantity, it is estimated that only about half this quantity reach the export tanners and as many of these are badly branded or otherwise defected, many of these are sold locally and still fewer finally reach the exporter.

CHAPTER III.

South Indian Tanneries.

Tanneries working for export are found in most districts in South India. In several places a considerable number of these are found grouped together within a very short distance of one another whilst in other cases single tanneries exist widely separated from one another. Madras City is the centre of the largest group of tanneries, as although tanning is not permitted within the municipal areas practically all the surrounding villages contain a number of tanneries. To the north near the Coast, Thangal, Tiruvottiyur, have a large number engaged in skin tanning and it is in this district that practically all the fresh skins from the Madras slaughter-houses are tanned. At Madavaram and Sembiam on the north trunk road there are also a number in which both hides and skins are tanned. At Kodambakkam, the second station from Egmore along the South Indian Railway line, there are a number of tanneries within a small area chiefly engaged in the tannage of hides, although a few of them also do skins. Further along this line and on the south trunk road there is Pallavaram which together with Meenambakkam and Chromepet contain over hundred tanneries working both hides and skins. This is the largest and the most remarkable group of tanneries in South India and at times of good trade, may employ several thousands of workmen. On the Madras-Calcutta line, several important tanneries exist at Bezwada, Ellore, Rajahmundry and Vizianagram, practically all of which are engaged in hide tanning whilst on the line from Bezwada to Wadi there are two important centres, Mutwada, a suburb of Warrangal, with 18 tanneries and Hyderabad City with 8 tanneries, where both hides and skins are

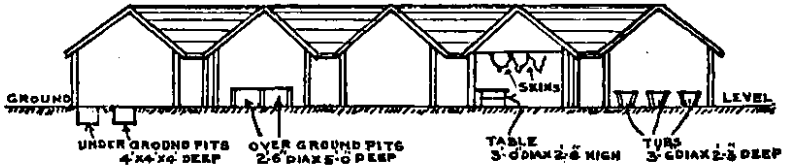
tanned in considerable quantities. On the Madras-Bombay line there are no large centres of tanning, but important tanneries exist at Cuddapah, Gooty, Adoni, Bellary and Raichur, all of which are engaged in skin tanning ; there is also a large hide tannery at Bellary. Following closely on the immediate neighbourhood of Madras, another important centre of tanneries exists in the North Arcot district on the south-west line of the Madras and Southern Mahratta Railway, extending from Ranipet to Vaniyambadi. In this neighbourhood there are well over a hundred tanneries chiefly situated at Ranipet, Vellore, Ambur, Gudiyattam, Pernampet, Vaniyambadi, but many of the other towns and villages in this neighbourhood have at least one tannery. In this district about equal numbers of the tanneries are employed in the tannage of hides and skins. Slightly to the north of this, Chittoor has a number of tanneries chiefly employed on hides. Bangalore is a very important hide centre and is considered by many exporters and users of tanned kips to turn out the best tanned kip produced in South India, but up to quite recently they tanned very few skins. On the broad gauge South Indian Railway line several tanneries exist at Salem, Erode and Coimbatore, chiefly engaged in the skin tanning trade, although one at Erode is one of the largest hide tanneries in the Presidency. On the narrow gauge South Indian Railway line, Trichinopoly and Dindigul are extremely important skin tanning centres and in both cases many of the tanneries are concentrated in a very small area on one of the road leading from the town. In the case of Trichinopoly eight important tanneries are found within half a mile of one another about 5 miles out of Trichinopoly on the Pudukkottai road, whilst the same state of affairs exists at Dindigul where about the same number of tanneries are crowded just outside the municipal limits on the Madura road. In addition to the places mentioned, single tanneries exist in villages both near and far from the various railways, those south of Madras being more often engaged on skins whilst those to the north more often tan hides.

Almost all tanneries in South India are built on square plan described by Chatterton in his monograph as follow :—

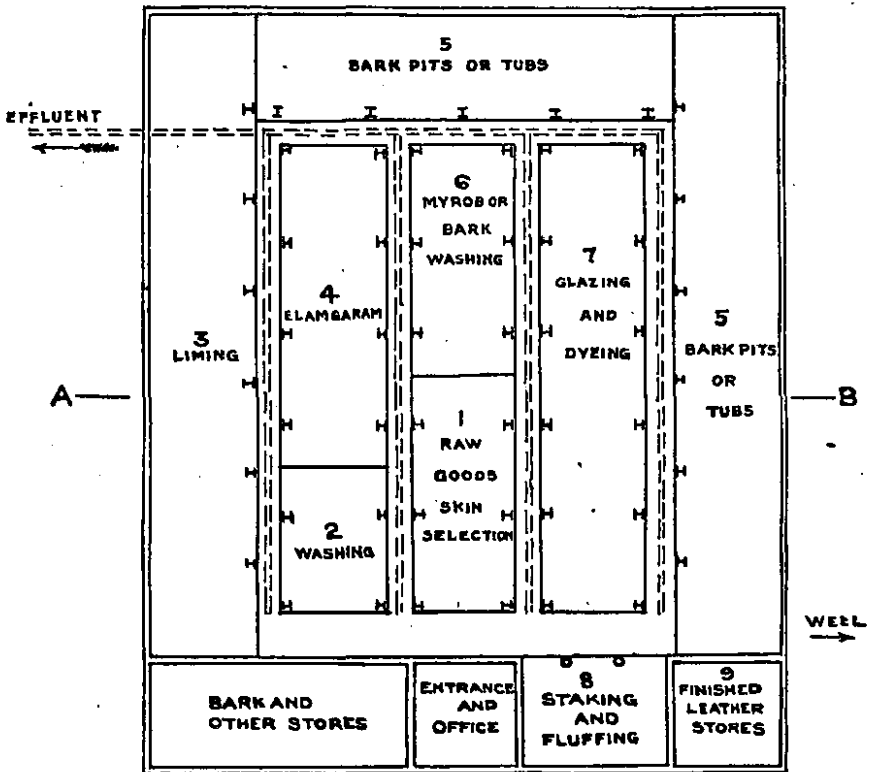
“ A typical Madras tannery consists of tiled sheds built on the four sides of a square or rectangle with a blank wall externally and opening on the inside to a quadrangle. A wide doorway in the middle of one of the shorter sides of rectangle gives access to the tannery. One half is devoted to the reception of the raw materials and to the carrying out of the process preliminary to tanning. The soaking pits are usually constructed below the ground level along the outer walls. They are generally square in plan and three or four feet deep, built of brick and plastered. For the removal of the lime after unhairing, tanks of bricks and plaster are usually built above the ground level with masonry aqueducts or channels to supply them with water. Skin tanning is invariably carried on in wooden tubs from 3 to 4 feet in diameter or more, and of about the same depth. Of these there are often more than one hundred.

PLAN. I

NOT TO SCALE



SECTIONAL ELEVATION A-B.



PLAN

EXTRA
WET
WEATHER
DRYING
SHED

-----DRAIN

In well arranged tanneries the coolies engaged in the preparatory processes are not allowed among the tanning tubs so as to avoid the risk of lime being carried over.

Hide tanneries are generally much smaller than those devoted to skins, but the arrangements are otherwise very much the same except that the tanning is often carried on in pits similar to lime pits. The capital outlay involved in setting up a tannery even of the largest kind is not much and there are numerous small tanneries in which a few hundred rupees would probably cover the whole cost. As a natural consequence, the work is carried on in tanneries very irregularly, all the more so as the tanners themselves have very little capital and are almost entirely dependent upon advances wherewith to buy skins or hides and carry on their business. In the past the profits of the Madras tanning trade were very considerable and this led to a reckless system of advancing money which naturally ended in heavy losses and during the last few years the system of financing the trade has materially improved. An enormous number of small tanneries have shut up and the greater part of the trade is now carried on in the larger tanneries under more competent management."

A few tanneries have been built during the last ten years and in cases where this has been done this square plan has been developed somewhat by increasing the size so that it has been possible to have three or four bays in the centre. The following plan although not that of any actual tannery that I am acquainted with is more or less typical of the better arranged tanneries built during the last twenty years. As the work follows the direction of the numbers it can be seen that there is little crossing as on the whole the goods follow on in a left-handed circle round the tannery.

PLAN I.

The work in a tannery built on the square plan is exceedingly easy to supervise as practically the whole area is visible from the raised pial at the entrance where the office is situated. In the same way everything that is brought in or taken out passes under the eye of the manager or his assistant. This plan has also several other advantages, the chief of which are the prevention of theft and the regular forward flow of the work. There is, however, one great disadvantage about this plan as it is almost impossible to increase the size if this is found necessary at any time. Where this has been attempted it usually has led to chaos and the building of an additional unit has been usually found much more satisfactory in every way. South Indian tanneries are, as a rule, when compared with some of the large tanneries in Europe and America, quite small, and although it has been the usual practice in Europe and America to increase the size of the unit the policy in South India has been rather to increase the number of small units working under the same management than increasing the individual units. This is more or less necessary on account of the question of water-supply

which is usually the limiting factor in the possible size and outturn of tanneries. As it is, many tanneries have at times to reduce the amount of work they can do on account of the scarcity of water.

The drying space in almost all tanneries is only sufficient for normal working in dry weather with the result that almost all tanneries have had to build extra drying sheds outside the tannery for use during wet weather. These are usually built of thatch and are of a temporary nature. All drying sheds depend entirely on air drying none having any means for warming or drying the air. This leads to considerable damage being caused by mould whenever periods of wet weather prevent drying of the hides and skins. At the normal temperature of the South Indian plains a healthy growth of mould appears and forms spores on tanned hides and skins in from 48 to 72 hours and when drying takes longer than this great care should be taken to prevent this growth. The two most useful antiseptics tested by the writer have been found to be "Fomalin" which at a strength of about 5 per cent keeps down the growth of mould for 24 to 48 hours and "Preventol" which at a much lower concentration, say one per thousand, keeps growth down for a considerably longer period. The only fault that the writer has found with "Preventol" is the original cost of the material which is considerable. During wet periods when leather will not dry out without the formation of mould it is wise to keep back the goods in bark liquors as less damage is done by delay at this stage than at any other.

Five export tanneries have installed fleshing and fluffing machines worked by power in their tanneries. In each case the machinery is in a separate building and not in the normal tannery. The installation of these machines has brought these tanneries under the Factory Act. In other tanneries little or no power is used, but recently several of the Bangalore tanneries have installed electrically-driven pumps, as the Electrical department of the Mysore Government have offered electric power at a very cheap rate for this purpose.

CHAPTER IV.

Processes.

The process employed by the South Indian tanners varies little from tannery to tannery except in detail and as far as the writer has been able to find out from the oldest people connected with the trade it has varied very little during the last 60 years. He is inclined to think that the important improvement made in the process by De Susa as mentioned in the first chapter were most likely the introduction of the present process and of the tools used in it. It is likely that no very noticeable changes have been made since his time except in the care taken and in the skill of the workmen. This naturally has improved considerably during the four generations

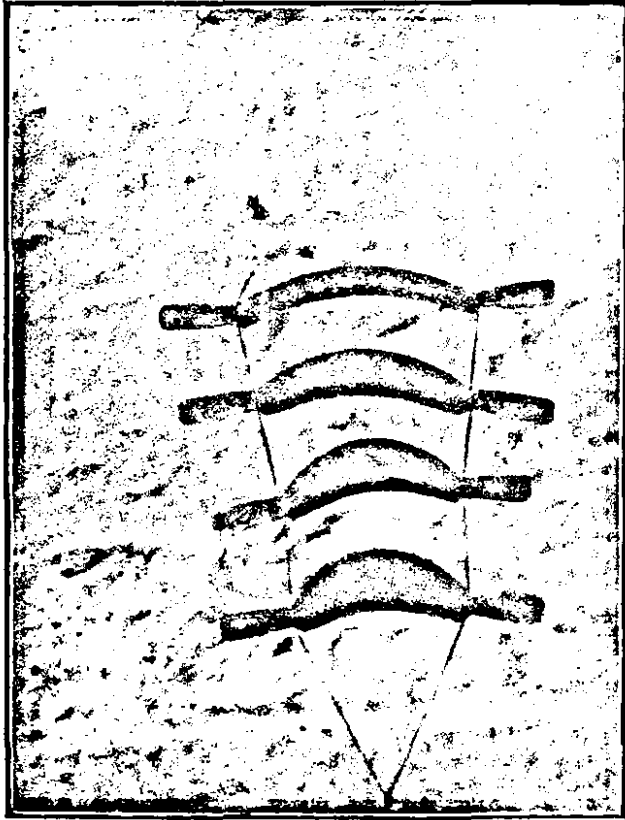


PLATE NO. I.

who have been employed since he taught them how to use certain tools and how to carry out certain processes. The general outline of the process now used are as follows.

Raw goods received either fresh, wet salted, dry salted or dried are first of all washed in water to bring them to soft and clean condition. This washing is done in pits built above the ground level so that the waste water can be run off quickly and easily. It may extend for a few minutes or for almost two days according to the nature of the material being worked. Details of this process are given in Chapter IX. Following the washing process the goods are limed that is left in pits (usually below ground level) together with water and lime in order to loosen the hair and to swell up the hide substance and flesh so as to make it possible to cut or scrape off the flesh by means of a suitable knife. The method of liming varies a good deal as can be seen in Chapter X, according to the class of goods worked by the tanner, but up to the present there has been no other material than lime used at this stage. Unhairing and fleshing are in the great majority of cases, still done by hand. The equipment for this process is of the simplest consisting only of semi-cylindrical beams made of palmyra wood on which the hides or skins are thrown and soft iron knives that vary slightly in shape according to the process and class of goods being worked. As mentioned in the previous chapter four or five tanneries now use machinery for fleshing.

The limed and fleshed skins are next treated by alternately washing in water and working over the beam, with the same type of knife as is used for unhairing and fleshing. This alternate working and washing takes the place of what is known as 'bating' in Western tannery practice and removes the lime from the hide or skin together with the hair roots, pigments and other unwanted material. The tendency in Europe and America is to cut down the costs by saving labour especially at this stage of the process, whereas in India it is still often possible to increase the value of the material by using extra labour. It is the extra work put into the hides and skins at this stage and during the tanning process, which immediately follows that makes Madras tanned hides and skins suitable for such a large number of uses. On completion of this process which is known as "Elangaram" the skin or hide is in clean condition free from all extraneous matter and is ready for the tanning process. As with washing the pits in which this process is carried out are always above ground level so as to permit of quick drainage. Details describing this process will be found in Chapter XI.

The tanning process is carried out by what is known as the Contact Process, that is, the tanning material and the prepared hides or skins are immersed together in water which acts as a media of transfer of the tannin from the bark or other material to the skin. The peculiarity of the method as compared with Western practice is the extreme weakness of the liquors which seldom exceed

about 10 per cent Barkometer, i.e., specific gravity of 1.010. The result of this is that the leather produced is usually of an extremely mellow nature and is also light weighing and consequently gives a large area for weight. Up to 1917, practically only Avaram (*Cassia Auriculata*) and Konam (*Cassia Fistula*) were used by the Madras tanners. During the world War when an immense amount of Madras tanned kips were required for military purposes the quantity of these barks was too small for the outturn demanded. Several other local barks were consequently tried and wattle bark was imported from South Africa. None of the local barks used were found to exactly suit the tanner but wattle bark was found to be a very good substitute and considerable quantities were imported during the trade boom following the War. In the slump of 1921 the import of wattle stopped to again begin in 1923 and steadily increased till 1929 when it was estimated that 95 per cent of the hides tanned were chiefly wattle tanned. When wattle bark alone is used about 1 to 1½ pounds of bark is required for each pound of leather produced and as the import of wattle are now almost equivalent to the exports of tanned hides and last year were actually larger, it can be seen that only an amount of kip leather corresponding to that used locally is now tanned with local barks. Up to the present wattle bark has only been used on hides, skins being still invariably tanned with Avaram. Details of the tanning process will be found in Chapter XII. Most skins are tanned in wooden tubs whilst many of the large tanneries use masonry pits for the same process, but others use tubs similar to those used by skin tanners but slightly larger. Whilst the hides or skins are being tanned they are worked over the beam once or twice which process tends to give the good pattern and well set out nature for which Madras tanned goods are noted. As practically all finished leather is now sold by measurement, it can be seen how this extra work may more than pay for itself. The combination of the hide or skin substance with the tanning from the bark completely changes the character of the material, so that what previously was exceedingly putrifiable when wet, and bone-like when dry, is changed into a material very stable when wet and reasonable flexible when dry. In other words the raw hide or skin has been changed into leather.

Skins or hides tanned by either local bark or wattle unfortunately are easily affected by light and change considerably in colour from the light almost white colour to deep red. This tendency is considerably reduced by finishing the tannage of the hides or skins with a different type of tanning material and the local tanners use myrobalams for this process. Many of the tanners do not consider myrobalams as a tanning material but rather as a bleach and colour fixer and it is interesting to note that in the case of one prosecution during the control period, a tanner prosecuted for tanning skins pleaded as his defence that soaking skins in myrobalams which he was doing was not tannage but only Dhori. (See Chapter VII.) On removal from myrobalams skins and hides are well worked out and then oiled and hung up to sam (i.e., half-dry) in which condition

they are set out and then thoroughly dried. This completes the process in the case of hides, but skins undergo two further processes staking and fluffing in order to soften and clean up the flesh side. Details of the work done after the tannage may be found in Chapter XIII.

The leather produced by the Madras tanners is what is known as 'crust' leather, that is, leather that has been tanned but not finished. The finishing is usually carried out in other countries after export. Unfortunately many laymen do not know that tanning and leather finishing and dressing are two distinct trades and these may be interested to know that at one time it was penal offence for a tanner in England to dress his leather as this was the guild right of another caste, the leather dresser. In some cases Madras tanned leather has been called 'half-tan' which is quite misleading as can be seen from Appendix VI of the Report of the Hides Cess Enquiry Committee, Volume I, "A note on the term Half-tan and its synonyms."

CHAPTER V.

Tannery Owners, Staff and Operatives.

Almost all the tanneries in South India are owned or worked by Muhammadans. Those in the Southern districts are usually natives of the district in which the tannery is situated, but the owners of tanneries elsewhere are usually natives of the North Arcot district who seem to take a particular interest in the tanning trade. Tanneries may be divided into four types according to ownership—

- (1) Tanneries worked, owned and financed by a single owner or by two or more in partnership.
- (2) Combines of several tanneries in which a firm or individual may be considered as the controlling partner whilst one or two other individuals connected with the management of the different tanneries are the junior partners and have an interest in the particular tannery in which they are employed but not necessarily so in any of the other tanneries of the combine. This type of combine is more important in the skin section than to the hide section.
- (3) The third class is that of the tannery owned and managed by one or more individuals but financed by a Commission or Export House in Madras.
- (4) In the Southern districts, there are a large number of traders who visit out-of-the-way districts and collect skins and hides for some time. When their available capital is exhausted, they return to Dindigul or elsewhere, hire a few pits and tubs in a tannery and proceed to tan the hides and skins collected. When this process is finished, they give up the tannery and take the skins to Madras for sale. The proceeds of the sale are then used to start another tour for purchasing.

The staff of most of the tanneries consist of the owner and his relations and in many cases they are given an interest in the business rather than a definite salary. In the same way the departmental supervisors are often relatives of the staff or managers but the actual supervision of labour is usually carried out by ex-workmen-maistris who have been picked on account of long service or special ability.

The actual labour is almost always done by Hindu or Christian workmen. There are however in a few cases a few Muhammadans working in the finishing process. A good deal of information regarding the castes and classes who do the work is given in Chapter II of Chatterton's monograph and in the District Manuals. These may be consulted if any information on this point is required.

As few of the South Indian tanneries are factories coming under the Factory Act, there are no regular returns of the labour employed. The following table gives extracts from the latest available Census Returns showing the number of tannerers, curriers and leather dressers in the districts in which tanning is most important :—

Tanners, Curriers, Leather Dressers and Dyers.

Total, Madras Presidency—					1911	1921
Men	...	...	...	...	12,914	6,409
Women	...	...	...	...	882	766

Districts in which there were more than 300 at any census.

Bellary	...	...	...	...	722	61
Anantapur	...	...	...	...	310	4
Chingleput	...	...	...	...	2,970	2,662
Chittoor	...	...	...	...	414	522
North Arcot	...	...	...	...	835	324
Coimbatore	...	...	...	...	745	119
Trichinopoly	...	...	...	...	3,332	404
Madura	...	...	...	...	829	866
Tinnevelly	...	...	...	...	1,161	850

Although the 1921 Census was taken at a time of unprecedented depression in trade as can be seen by the graphs in Chapter II, some of these figures are difficult to understand. As an example the total labour employed in North Arcot district in 1921 is only given as 324. When we consider that in this district there are about 100 tanneries many of which are of considerable size it is difficult to account for the smallness of this figure. On the other hand the figures of 1,161 and 852 for Tinnevelly for 1911 and 1921 respectively seem exceedingly high as there are no export tanneries of consequence in that district and it is unlikely that there are so many village tanners.

As the amount of material tanned and the conditions under which it is done are fairly well known, it is possible to make an estimate with reasonable accuracy the amount of labour employed and the wages earned during any period, taking the export of leather as the basis for the calculation. In this way, I have made an estimate for

the year 1928-29 when exports were a record. For other years it is simple to make a proportionate estimate using these figures for the purpose.

The cost of labour in practically all the hide tanneries works out at slightly over 6 pies per pound of leather produced so that during 1928-29 it may be estimated that the labour in hides tanneries received $\frac{14,800 \times 2,240}{2 \times 16}$ or Rs. 10,00,000 as wages. In the same way if we consider that skin tanners pay their labourers about $1\frac{1}{2}$ annas for each skin tanned the amount paid in the same year will be $\frac{21,500,000 \times 1\frac{1}{2}}{16}$ or about little over Rs. 20,00,000. These figures are based on leather exported and to this may be added at least an extra 10 per cent or 3 lakhs for leather used in India.

In addition to this the trade finds employment indirectly many other ways. As an example of this I may mention the collection of tanning materials. In 1928-29 most of the hides were tanned with imported wattle bark so that the amount of avaram bark used may be calculated from the skins exported.

The exports of tanned skins were about 6,000 tons and as each pound of leather tanned used about 3 lb. of bark, it can be estimated that at least 18,000 tons of avaram bark were used on skins exported. Bark is sold by the candy of 500 lb. and these cost from Rs. 30 to Rs. 45 per candy of which the labour employed in collection received about Rs. 10 or more per candy. As 18,000 tons is equivalent to about 80,000 candies the cost of the labour employed in collection of this material was at least Rs. 8,00,000.

Practically all the hides and skins exported are selected and packed by firms in Madras and many also pass through a mundy in Periamet. Considerable labour is employed in both of these types of godowns and if we estimate the cost of labour in handling, carting, selecting and packing each bale of hides at Rs. 2-8-0 and about Rs. 3-8-0 for skins, we get an amount of Rs. 1,10,000 for hides and Rs. 70,000 for skins for the year for which the estimate is taken. The labour employed in the curing and handling of the raw skins is another important item and although much more difficult to estimate with anything like accuracy, I do not think a figure of $1\frac{1}{2}$ lakhs for hides and skins produced in South India is too large. We can thus get a minimum total as shown in the following table :—

	LAKHS.
	RS.
1 Direct labour in hide tanneries	10
2 Direct labour in skin tanneries	20
3 Plus 1/10 for leather used in the country	3
4 Collection of avaram	8
5 Packing of hides	11
6 Packing of skins	7
7 Curing and handling of raw goods	15
Total	44.3

An estimate of the number of men employed may be made in a similar method. Enquiries made by me in various tanneries all over South India show that for each man employed and working regularly in a hide tannery there is an outturn of about 16 to 20 lb. of leather per day or say $2\frac{1}{2}$ tons per annum. We can thus estimate the number employed in 1928-29 as $\frac{14,000}{2\frac{1}{2}}$ or say 5,500. Estimating in the same way and taking as the standard six skins per day for each workmen or 2,000 skins per annum we estimate that there should be about $\frac{22,000,000}{2,000}$ or 11,000 men working full time.

The whole of the labour employed in the collection of bark is part-time labour as the work is a subsidiary occupation so that it is impossible to make any calculation as to the number of people employed in it. On the other hand handling any packing of goods for export in Madras gives regular and whole-time employment to a large number of men and boys which I think may be taken at a minimum of 800 to 1,000 for the year under reference. In the curing and handling of raw hides and skins both part-time and whole-time labour is employed so that here again it is impossible to do more than guess the number of people employed. From these estimates we can see that the whole-time labour employed in the trade in the year 1928-29 was about—

In hides tanneries	...	...	...	...	5,500
In skins tanneries	...	...	...	...	11,000
Plus for leather not for export but used in the country, say	...	...	...	...	2,000
Packing, etc., in Madras	...	...	...	...	800
				Total	19,300

As in the previous table these figures may be taken as rather on the low than high side.

CHAPTER VI.

Technical Education, Advice and Research.

In 1910, the Government of Madras were asked by Mr. Chatterton, the then Director of Industries, to engage a Leather Expert for the Presidency, and the writer was engaged from September 1911. When he arrived there was no laboratory accommodation in which he could work so that after drawing up a scheme for a teaching institution he spent a considerable time in various tanneries in South India in order to become acquainted with the processes and peculiar difficulties of the local industry. After about a year a small chemical laboratory was equipped in the office of the Department of Industries and the Leather Expert did considerable work on water, spent

barks, etc., of local tanneries especially of that of the German firm Carl Simon, who at that time tanned a large number of skins in Madras.

The Department of Industries at that time were putting before the Government a scheme for a technical institute to deal with the large number of subjects of which the leather trade was one. The heart of the scheme was that a central institute should be formed which would contain the necessary laboratories, class-rooms, etc., for all departments whilst each trade would have a workshop in a separate building in the same compound. In 1913-14, Government sanctioned the formation of the Leather Trades Institute (i.e., the workshop of the Leather Industries Department) but rejected the proposals for the general institute. The building of the present Leather Trades Institute was completed in 1915 and the first course was started in June of that year when three students joined the classes. Soon after this, the Leather Expert went on active service with the volunteer unit to which he belonged and the institute was then carried on by Dr. Marsden, the Dyeing Expert of the Department, with the help of Mr. Mason, the tanner of the Chrome Leather Company. In 1916, Mr. Kurup, a returned scholarship-holder, who had studied in the Leather Sellers' College, London, was engaged and took over control of the institute and remained as Officer-in-charge till December 1917 when he left to join a firm in Calcutta. In June 1917, Mr. Rajamanikkam Nayudu, the present Superintendent, who had also been trained in the Leather Sellers' College, London, was engaged as Assistant and when Mr. Kurup left he was appointed Officer-in-charge. The writer was recalled to Madras in 1917 by the Army Authorities to act as Deputy Controller of Hides, but whilst doing this work he found time to take certain classes at the Leather Trades Institute to which he returned as Principal in June 1920. On his return the course of the institute was revised and brought more into line with the courses in Leeds and London, which up to that time was impossible on account of the insufficiency of the staff. The demand for admission at this time was very great and the number of students had to be limited to the space available in the institute laboratory which had been placed in a room originally intended for other work. By making further additions to the laboratory it was possible in 1920-21 to take 42 students which was the maximum ever reached in the institute. As this was the year of the great slump in the leather trade it is not to be wondered at that requests for admissions fell off. During 1922-24 the fees, which up till then had been Rs. 80 per annum, were raised considerably to Rs. 150 for Madras and Rs. 300 to those from other Provinces. From this time the number of admissions decreased very considerably and in 1924-25 fees were again reduced to Rs. 100 for Madras and Rs. 150 for students from the other Provinces. Even this reduction did not stop the fall in the number of students till in 1926-27 there were only three students attending the institute. The following year proposals were made to take a certain number of students without fees and sanction for this was

only obtained after the session should have started and at a time when most students had joined some college or made other arrangements. To this offer six students responded and joined the institute for a two years course. Of these, five completed the course in March 1929 of whom four obtained employment in the trade. When the number of students in the institute was very large and there were many more demands for admission than could be admitted, proposals were sent to Government for increasing the building accommodation of the institute by the addition of two class-rooms and a laboratory and in 1924-25 the extension was sanctioned and was completed the following year. This building contained a very well-fitted up laboratory for students and a research laboratory in addition to class-rooms, stores, etc.

In 1922, the Principal pointed out that on account of the large number of students and the smallness of the staff there was little chance of any research being done in the institute and asked for assistants for this purpose. In January 1923 Government employed Mr. K. Seshachalam Choudari, M.A., M.Sc., as Research Chemist. At that time the laboratory accommodation was extremely limited so that it was impossible to have other assistants but in 1925 an extra assistant was also employed and a scholarship given to an old student permitting him to continue his work for an extra year in the laboratory as a research student. This scholarship was given regularly for four years but was discontinued in 1929. During the course of its existence the institute trained over 100 students of which over 30 are still known to be connected with the trade in positions of trust and responsibility and in some cases run business of their own. It is interesting to note that the prospectus of the training courses at the Punjab Government Tannery, Shadara, 1926, which has since been closed down, showed that the three tanners on their Tannery staff were all trained in the Leather Trades Institute, Madras.

Although the examination for the City and Guilds Institute certificates takes place during the vacation when most students were away from Madras four students of the Leather Trades Institute appeared for eight Final Examinations in Leather Manufacture at the Madras Centre. Of these four passed in the First Class, three in the Second and one failed. The four First Class certificates include two in Light Leather, one in Heavy Leather and one in Leather Dyeing, which shows the all-round nature and quality of the instruction given.

The extensions completed in 1925-26 were handed over in January 1929 to the Textile section of the department and consequently the Leather Trades Institute is at present housed in the building originally constructed in 1914-15 so that the laboratory is small for the work that is being done in it.

In addition to research and routine work on leather the staff of the Leather Trades Institute has always had to carry out most of the chemical work of the department except that connected with soaps and oils and fats, which has been done in the Soap Institute

at Calicut. As this general chemical work has always been very considerable it is impossible to expect a large amount of research work to be done.

In addition to the full courses for the students given in the Institute, the Principal on three occasions delivered series of lectures on Madras tannages open to the public and quite a number of young men both Indian and European connected with the tanning and export trades took advantage of these courses and attended them. One of the assistants also took two courses in Tamil for the maistris employed in Pallavaram tanneries. The Chrome Leather Company kindly lent the school hall for these classes and a large number of departmental maistris attended.

Much of the work of the Institute has been of an advisory nature and not of a type on which it was easy to publish bulletins with the result that the actual printed matter published by the Institute has not been great. A list of the chief publications of the Institute is shown at the end of this Chapter. Copies of some of these are still available. It may be of interest to point out that the Chrome department of the N. Muhammad Mian Ravuttar Tannery was up till quite recently staffed entirely by ex-students of the Institute and may be considered to be a direct outcome of the training provided therein. The product of this tannery is well known in all the boot making centres of India and its leathers are considered quite as good, as those made by any other firm in India.

It has been pointed out in a previous chapter that the tannage of reptile skins in the Madras Presidency is now a considerable trade and exports during 1928-29 amount to over 20 lakhs of rupees in value. The Institute has trained many of the men doing this trade and it can claim directly to be one of the pioneers of this trade, for as early as 1917 it exhibited samples of various tanned reptile skins in the All-India Exhibition held in Madras and in 1919 a student sent a number of consignments to England to test in the market.

During the Control period the scarceness of bark was the principal cause of the limit to the amount of leather tanned in Madras and when wattle bark was first imported into Madras experiments were carried out in the Leather Trades Institute to show tanners the way in which it could be used as a supplement or a substitute for avaram and the experience gained during these experiments was shown to many tanners. A number of those who afterwards became the pioneers in the use of wattle obtained their first knowledge of its use and properties in the Leather Trades Institute. No bulletin about its work was published by the Leather Trades Institute but the Munition Board issued a note to tanners who bought wattle bark based on the work done in the Leather Trades Institute giving information as to the methods of use. Unfortunately no copy of this communication is now available. As at the present time practically all the tanned hides exported from Madras are to a greater or less extent wattle tanned it can be seen that the lead given by the Institute has spread all over the Presidency.

During the course of its existence, the Institute has been visited by tanners from all over India for advice and information and in one case two Cawnpore tanners came all the way from Cawnpore in order to consult the Principal regarding defects in their processes, and on their return to Cawnpore wrote a letter thanking the Principal for the information given them.

Mr. N. F. Nichols of Joppa, Leeds, one of the largest English tanners and curriers—on visiting the Institute on January 8th, 1923, wrote in the visitors' book

“ This is the most interesting and instructive Institution of the kind I have seen in any country.”

The reason for the falling off in the number of students from 1920-1928 is a matter for speculation. However the causes suggested below may be considered as having something to do with it. Up till 1921-22 quite a large proportion of the demands for admissions came from students from other provinces and this ceased almost entirely when their fees were raised to Rs. 300 per annum. Added to this students from other provinces were kept away by the opening of the Calcutta Research Tannery and later the Punjab and United Provinces leather departments and also the starting of apprentice classes in the Government Harness and Saddlery Factory, Cawnpore. The prospectus of the Punjab Government Tannery, 1926, shows that free tuition was given and no fees charged. A second reason was that a certain number of the people applying for admissions in the early days of the Institute had looked upon technical education as a means of quickly becoming rich and when they found that it meant hard work after they left the Institute they were disappointed and consequently did not recommend their friends to take up the courses. Thirdly the Madras tanners had normally been paying exceedingly low salaries to their maistris and foremen and did not see the advantage for paying a much higher salaries for a trained man until he had proved his value, with the result that for some years the men employed in Madras were poorly paid and consequently parents were unwilling to send their boys to the Institute. This of course is a thing that should have been foreseen and it is only since the closing down of the teaching side of the Institute that the men trained in the Institute are beginning to make a name for themselves and to be drawing reasonable salaries or making a good profit on the work they are doing. A fourth cause may be that other departmental Institutes, for example the Textile Institute, took students without fees and had in addition a certain number of scholarships. Fifthly the students had practically no chance of Government employment or employment in schools, etc., that are State-aided. Sixthly the fees Rs. 150 charged to Madrasis from 1923-24 to 1925-26 were as high as those charged in the first-grade colleges for degree students. Again the slump of 1920-21 may be mentioned as the losses made by the trade were so colossal that people not connected

with it were frightened away from it. Lastly the educational qualification of the sons of most of the local tanners was not high enough for them to take advantage of the courses of the Institute.

In January 1930 the Government issued orders dismissing certain of the staff and dividing the remainder into two water tight compartments one of which was to deal solely with stains on Madras tanned hides and skins, whilst the other was to deal with all other matters.

A few months later however in another Government Order the preparation of this book was added to the work of the Stains Section.

Nos. 23 to 28 in the following list of publications are the work of the "Stains" section. Number 29 has been issued by the general section.

List of Bulletins, etc., published by the Leather Trades Institute.

- 1 A Note on the Manufacture and cost of "One Bath" Chrome Liquors. *
- 2 Researches conducted in the Leather Trades Institute. *
- 3 The Re-tannage of Dhori Hides for sole leather. *
- 4 Detection of Mineral Oil in Vegetable Oil. *
- 5 A Simple test for the presence of Epsom Salts in Tanned Skins. *
- 6 A Simple method to get rid of Sediment containing iron from Tannery Waters. *
7. Wattle Gum Stain. *
- 8 A Note on South Indian Divi Divi. †
- 9 Fermentation of Divi Divi Liquors I. ‡
- 10 Fermentation of Tan Liquors. §
- 11 South Indian Tanning Materials. A Comparative Study. ||
- 12 Fermentation of Divi Divi Liquors II. Acidity of Divi Divi Liquors. ||
- 13 Wattle Bark—Its Use and Cultivation in South India. *
- 14 Studies on Avaram Bark I. ¶
- 15 Divi Divi (*Caesalpinia Coriaria*). *
- 16 Bark of *Hopea Parviflora* as a Tanning Material (1928). **
- 17 Bark of *Hopea Parviflora* as a Tanning Material (1929). *
- 18 South Indian Myrabolams—A Study. *
- 19 Soaking of Salted Skins. ††
- 20 The Weight of Madras Tanned Kips. ††
- 21 The Madras Leather Trades Institute. ††
- 22 A Preliminary note on Chlorine in Indian Tannery Waters. §§
- 23 Stains on Madras Tanned Hides and Skins. |||
- 24 Preliminary Report on Stains Developing on Packed Hides. *
- 25 Removal of salt stain during the Tanning Process.* (English and Tamil).
- 26 South Indian Tannery Waters.* (English, Tamil and Telugu.)

- 27 The Effect of various additions to Marine Salt for use as a Cure for Hides and Skins. ¶¶
- 28 "Chipped Grain" on Madras Tanned Sheep Skins (in press). * (English and Tamil).
- 29 Note on a Simple Test for the presence of Epsom Salts in Tanned Skins. *

References.

- * Departmental Publication.
- † Journal of the International Society of Leather Trades Chemists—April 1924.
- ‡ Ibid—January 1925.
- § Ibid—March 1925.
- || Ibid—June 1926.
- ¶ Ibid—February 1928.
- ** Indian Forester—September 1928.
- †† Proceedings of the Indian Section of the International Society of Leather Trades Chemists—January 1929.
- ‡‡ Ibid—April 1929.
- §§ Ibid—January 1930.
- ||| Ibid—December 1931.

CHAPTER VII.

Miscellaneous.

Although the staple trade of tanners in Southern India is the manufacture of leather for export, as has been explained in previous chapters, there is also a considerable amount of leather tanned for local use and for sale in other parts of India. Amongst the chief classes of leather manufactured for this purpose are :

- (1) Dhori hides.
- (2) Chrome leather
 - i For gin rollers,
 - ii For sole leather.
 - iii For upper leather.
 - iv Others.
- (3) Bark sole leather.
- (4) Fancy leathers.
- (5) Miscellaneous leathers.

1. *Dhori hides*.—The tannage of dhori hides most likely existed as a village industry all over South India long before the tannage of skins and hides for export developed. Since the development of tanneries, this trade has been a common side-line in many of them all over South India but it is still also carried out as a village industry in certain places. The process consists in tanning the hides after sewing them into bags (hence the name) and hanging them so as to cause the weak tan liquor which is poured into them to percolate through the hide thus causing a quicker tannage than when the goods remain still in the liquor. This method may be considered the indigenous method of tannage in India and is still common all over the country from the extreme north to south and east to west. The chief difference in this process found in different parts of the country is in the nature of the tanning material employed.

* Departmental Publication.

In most parts, some bark of local origin or a mixture of the bark and myrabolams are used. In South India however it is usual, though not universal, to use myrabolams only. Heavy buffalo hides of local origin are the usual material tanned and the leather is chiefly soled in the locality for sandals and soles of cheap quality shoes. In some places, the leather is also used for well buckets (kavalais or mhotes) and for water bags (pukals) where these are used. The myrabliquor used in the last process of the export leather trade is usually not fully expended and this forms the chief material used in this tannage, when carried out in tanneries, although in many cases it has to be supplemented by further material. Owing to the introduction of chrome leather during the last 25 years, and its cheapness and popularity for sandals, the manufacture of dhori leather has considerably decreased though the tanners in Bangalore and certain other places still tan a considerable amount. The leather is always very absorbent and is hence unsuitable for soles of boots likely to be used in the wet weather. It can however be turned into a much better article by laying away some time in strong liquor when quite a useful sole leather is produced (Leather Trades Institute Bulletin No. 2—Retannage of Dhori Hides for Sole Leather—1926). Dhori hides in the tanned condition are never set out and flattened so that they appear extremely rough and crude.

2. *Chrome Leather.*—Unlike the normal trade of the Presidency which is carried out with very simple equipment, the tannage and finishing of chrome leather, other than that of cheap quality sole leather, demands considerable machinery and hence can only be carried out in factories equipped with machinery of which are at present three working in the presidency and immediate neighbourhood. There have, however, at times been other factories working of which an account follows : At the time Mr. Chatterton wrote his Monograph on the Leather Trade of the Presidency, Mr. G. A. Chambers had been and was still experimenting on chrome tanning in his tannery at Tondiarpet. For several reasons he later on decided to move this tannery outside the City of Madras as the neighbourhood where it was then situated, was very unsuitable on account of its malarial nature and difficulties regarding water and effluent. He then chose a site at Pallavaram and started a factory which has since developed into The Chrome Leather Company, one of the largest tanneries manufacturing finished leather in the East. During this time, this factory has turned out very large quantities of all classes of leather for which there is any demand in India and also large quantities of other types of leather finished and unfinished for export.

About ten years ago Mr. N. Kajamian Ravuttar of Trichinopoly after some experimenting on chrome tanning engaged an ex-student of the Leather Trades Institute to assist him and shortly afterwards added a chrome leather factory to his tannery which had previously turned out skins for export. This factory is still working and is the only one of its kind in South India that has always been owned

and managed by Indians. The chief outturn of this factory has been chrome kip sides for boot uppers, but other classes of goods have also been made.

About four years ago Messrs. Gordon, Woodroffe & Co., built and equipped a tannery at Pallavaram turning out chrome upper leathers, both chrome and bark sole and various other types of leather.

Some twenty years ago a limited company, the Mysore Tannery, Ltd., started a chrome leather tannery near Bangalore City which manufactured certain classes of chrome leather for over ten years. On account of the financial difficulties of the Calcutta firm who acted as the managing agents during the post-war slump, production had to be stopped and although a Madras firm tried to revive this at a late date, they were unable to make it a paying proposition and hence the building and machinery were sold about six years ago. The purchasers of the building and machinery have kept them in tact but have done little or no work during the last six years.

The South Indian Leather Company started a factory at Madavaram shortly before the war and turned out considerable quantities of chrome leather for a period of about six years. They also produced considerable quantities of equipment leather and manufactured equipment of various types for the Munition Board during the war. They however closed down during the post-war slump and the factory has not been restarted.

The Cochin Tanneries, Chalakudi.—This limited company was floated at the end of the war and machinery, etc., purchased during the period of exceedingly high price. Production, however, only started during the severe slump of 1920-21. The factory suffered considerable damage during the great floods of 1923 and this together with the financial difficulties caused it to be closed down.

The prospectus of at least other two companies for the tannage of chrome leather in Madras were issued 1919-20 in but fortunately did not obtain sufficient capital to go to allotment and hence did not lose it in the slump of 1920-21 as did the other companies formed in Calcutta and other parts of India about that time.

Chatterton in his Monograph considered that one of the chief features for chrome leather in South India was for well buckets, but although it has been shown in certain districts to be much more economical than ordinary leather in other districts it has proved an entire failure due to the difference in the character of the water, so that this trade has never become as important as envisioned by Chatterton. Other classes of chrome leather have however become of great importance and have almost entirely replaced bark tanned leather in India for gin roller leathers and for the upper of better class boots and shoes.

Cotton ginning rollers made from bark tanned leathers quickly polish with a resultant reduction in outturn whilst chrome leather keeps its fibrous nature for a long period and hardly polishes at all and consequently keeps production at a higher and more steady level. Three main types of chrome leather washers are in demand according to the nature of the cotton. These are (1) whole washers, (2) sectional washers and (3) composition washers. There is a demand for each of these from different districts according to the nature of the cotton and the relative efficiency of the particular roller for this type of cotton. Generally speaking the longer and finest staple cotton gives the best results with whole washers whilst for short staple composition washers are used. As the name implies whole washer rollers are made up of full circles of chrome leather the diameter of the roller perforated with a hole slightly larger than the steel shaft on which they are placed and compressed.

Sectional rollers are made up of smaller pieces of leather of full substance such as the cuttings from whole washers which are sewn together in the form of rough circles and are then stamped out to the proper size.

Composition rollers are a by-product of the shoe leather trade and are made up chiefly from the flesh splits removed from the upper leather. These are made into discs of about one inch thick by both pasting and sewing and are then stamped out to the size required. So great has been the demand for these composition washer that a considerable amount of chrome splits have been imported from other countries. Some idea of the quantity of leather used in cotton gins in India may be obtained when it is considered that most ginning factories estimate the cost of the leather used in the rollers at from 2½ to 8 annas per bale according to the quality of the cotton and class of leather used. If we take 5 annas as the average and 6,000,000 bales as the production of cotton the value of leather required for this will be about 20 lakhs per annum. Madras and especially the Chrome Leather Company, fortunately holds a very important position in the production of these supplies.

Chrome sole leather.—The material has to a great extent replaced dhori hides for sandals in most parts of South India. It has been manufactured not only by firms equipped for chrome leather manufacture but in many small tanneries where a small overhead charges have made it possible for them to under-sell the factory-made materials. Much of the leather produced in the small tanneries has been of a very low quality but on account of its low price has met with ready sale.

Chrome Kip Side leather for uppers of the box and willow types are the chief outturn of factories specialising in shoe leathers. The population of South India unfortunately uses extremely few shoes or boots, so that the greater part of the outturn of the South Indian

Chrome leather factories has to be sent to other parts of India chiefly in the North or West or to be exported. The Indian demand for upper leather has at any rate during the last few years been exceedingly difficult one to satisfy as demand has usually only been for one selection, making it extremely difficult to work a tannery as it is impossible to buy hides giving one selection only. At the present time the demand is for the very lowest selection possible whereas a few years ago a much better selection was required.

A certain amount of glaze goat has also been manufactured but demand for this leather in India is very limited whilst exports have never been of any considerable consequence.

Bark sole leather.—Two of the factories making chrome leather have manufactured considerable quantities of heavy buffalo hides for bark tanned sole. Trade in this is badly handicapped in South India as there is little demand for this class of material locally and the railway freight to the centres where it is required is very heavy. A certain amount was however been exported.

Fancy leathers.—A certain amount of many classes of fancy leathers have been made but as demand is small and erratic in India it has been a very irregular trade. Finished reptile skins have been exported in large quantities by the Chrome Leather Company, and by Messrs. Gordon Woodroffe Leather Manufacturing Company, since the demand of this class of leather arose. A number of other firms have also exported large quantities of unfinished tanned reptile skins either bark tanned or white tanned by alum or a combination of alum and aldehyde.

Miscellaneous leathers.—During the war considerable amount of harness and equipment leathers were carried and made into equipment in Madras but since then very little of this type of leather has been made. However as in the case of fancy leathers small orders of bark leather for boot uppers are occasionally received and are carried out. Mill leathers are in the same way occasionally made to order. These include such things as belting, roller leathers, laces, etc.



PART II—TECHNIQUE OF THE INDUSTRY.

CHAPTER VIII

Raw Materials.

In most parts of the world the tanner's chief raw materials consist of the hides and skins from animals slaughtered for food. South India is as far as skins are concerned no exception to this rule ; but with regard to hides, a very different state of affairs exists. A great proportion of the inhabitants of South India are vegetarians and amongst meat eaters there are very few that will eat beef. In other parts of India the Muhammadan population, as a rule, are beef eaters, but the South India Muhammadans although they eat mutton, will not touch beef. The result of this is that very few cattle are slaughtered for food in South India, so that, there are very few slaughtered hides available for tannage and it has been estimated that about eighty or ninety per cent of the hides tanned in South India are those from fallen animals whilst most of the slaughtered hides are imported from other districts.

Hides.—The number of hides available from slaughter houses in South India is with one or two exceptions negligible. The only places of any consequence except the West Coast which will be dealt with separately are Hyderabad including Secunderabad (about 30 hides daily), Madras (50 hides) and Bangalore (100 hides), where due to large garrison and European and miscellaneous population a certain amount of beef is consumed. Elsewhere the number of cattle slaughtered is infinitesimal. The West Coast, however, is quite different as there is not only a large Christian population who are beef eaters but also a large proportion of the Muhammadans, the Mappillas who do the same. The difference can well be seen in studying the returns from certain slaughter houses when it can be seen that in certain West Coast Towns there is one beast slaughtered for every two or three sheep or goat, whereas in the South Western districts the average is about 1 to 60 or even more. In certain places, i.e., Bangalore, the hides are dealt with in a very peculiar method. In most parts of the world the butcher buys the animal and after slaughtering it, sells the hide to the tanner. In Bangalore, however, the tanners themselves inspect the live animals and buy the hide from this inspection ; later on the animal is slaughtered and flayed by the butcher and the hide afterwards delivered to the tanner. In all parts of the world except in the highly organized slaughter-houses, such as the packing house of America, there is always great difficulty in getting the butcher to use sufficient care in flaying to prevent damage to the hide, and it can easily be seen that bad flaying is still more likely in Bangalore, where the butcher has no interest whatever in the hide except in having to remove it, which he naturally does as quickly and as cheaply as possible. In Hyderabad, Bangalore and Madras, the slaughtered hides are

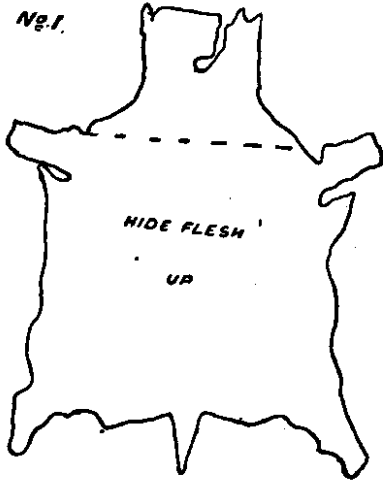
usually sent direct to the tanneries and are sent to them either fresh or very slightly salted as they are put into work almost immediately. On the West Coast where there are no tanneries working for export it is much more common for them to be bought by hide dealers who cure and pack them and export them to tanneries in other parts of South India.

The hides produced in different parts of the country either slaughtered or fallen vary very considerably according to the nature of the cattle in the district. It is impossible in a book of this scope to go into the question of different types of hides fully, but a few examples may be mentioned ; Bangalore hides are usually well grown, fairly plump hides of medium size weighing about 8 to 9 pounds when tanned, whilst the Hyderabad type are noted for their square shape and good pattern. Madras hides have no distinct characteristics as Madras is the centre of a district with a very great variety of cattle, bordering as it does on the district where there are large Nellore animals which often run as high as 15 hands, whereas to the South a much smaller type of animal is found. In addition on account of the large demand for draught and milch animals in the city, cattle are often imported from considerable distances. West Coast hides are, as a rule, both small and light in weight and are hence much sought after by tanners as light weight hides are, as a rule of much higher value than the heavier weights. As West Coast hides have to be exported to considerable distances it is necessary that they be thoroughly salted. The normal method of salting is as follows :—

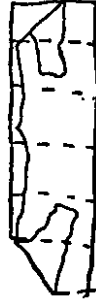
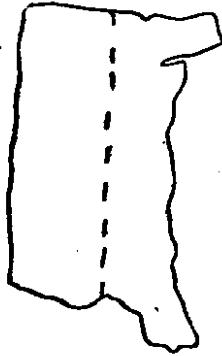
Hides are from both slaughtered and fallen animals and are brought to the dealers either fresh or after a preliminary salting. After purchase they are freed from excessive flesh and are then spread flesh up on the ground and are sprinkled with finely ground salt which is then rubbed in by hand. The hides are then folded as shown in the diagram.

DIAGRAM I.

No. 1



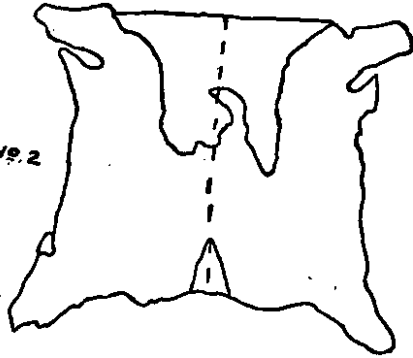
No. 3



No. 5 - - - - SHOWS THE FOLD TO FOLLOW

HIDE SHOWING POSITION OF FOLDS ALONG WHICH STAINS USUALLY RUN.

No. 2



No. 4



TOP VIEW

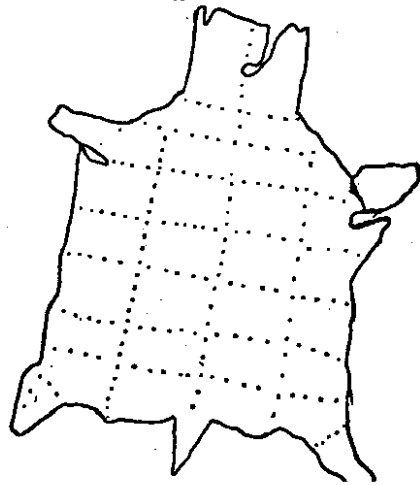


No. 6

END VIEW



No. 7



They are then put into piles and are left thus for a few days. During this time the salt withdraws the water from the fibres of the hide, from the blood, etc., forming brine. This escapes by being forced through the hide substance chiefly at the folds and trickles down to the floor where it either stagnates or escapes. This brine not only contains salt but the putrifactive matter from the blood, dung and any soil or other matter adhering to the hair. After 4 to 7 days the bundles are opened out, the hides placed in pile and further salt rubbed in as before. Hides are then rebundled as before, piled and stocked till sold or despatched to the tanneries. Examination of the brine shows that it usually contains from 20 to 27 gr. of salt per 100 c.c., that is, it is not quite saturated—large quantities of putrifactive organic matter and very large quantities of bacteria, chiefly of the types common in soil and the halophilic ones. The godowns in which the hides are stored vary very much in efficiency of drainage and in some cases the accumulation of brine is encouraged. Here and there the hides are actually stored in pits in which several of the bottom layers are covered with the brine. In most cases the godowns are kept closed as much as possible in order to prevent the drying of the hides with the result the air is saturated with moisture and much suited to bacterial growth. Ordinary marine salt is normally used after being ground. During the wet weather this salt absorbs considerable quantities of water and consequently has to be dried before grinding. After it has been dried by heating it in iron or earthen vessels over open fire, the grinding is done by women pounding the salt in wooden mortars by means of wooden pestles.

This method of salting together with the long period for which hides are stocked often leads to the hides being badly salt stained. These salt stains are particularly prevalent towards the end of the rains as usually hides are stored longer at this period on account of difficulty of transport whilst the excessive moisture in the air also tends to help the bacterial action which seems necessary to form these stains. The stains are chiefly found along the lines of folding and often form square patterns on the hides, stains on one side being, as a rule, much more intense than those on the other. Another common defect on West Coast hides are the depressions caused by the tick insect which is very prevalent in certain parts of West Coast. In addition to the hides slaughtered on the West Coast the hide merchants there also buy considerable numbers of hides from fallen animals and these are mixed with and treated in the same way as the slaughtered hides.

The last livestock census showed a cattle population of the Madras Presidency of about 16 millions together with 6 million buffaloes so that we may expect a production of about 2 million cow hides and half to one million buffaloes. As Madras exports about 3 million tanned cow hides and it is estimated to use about one million chiefly for kavalai (well buckets) it can be seen that the local supplies should be about half the requirements, the remainder being brought from other parts of India. Most of the buffalo

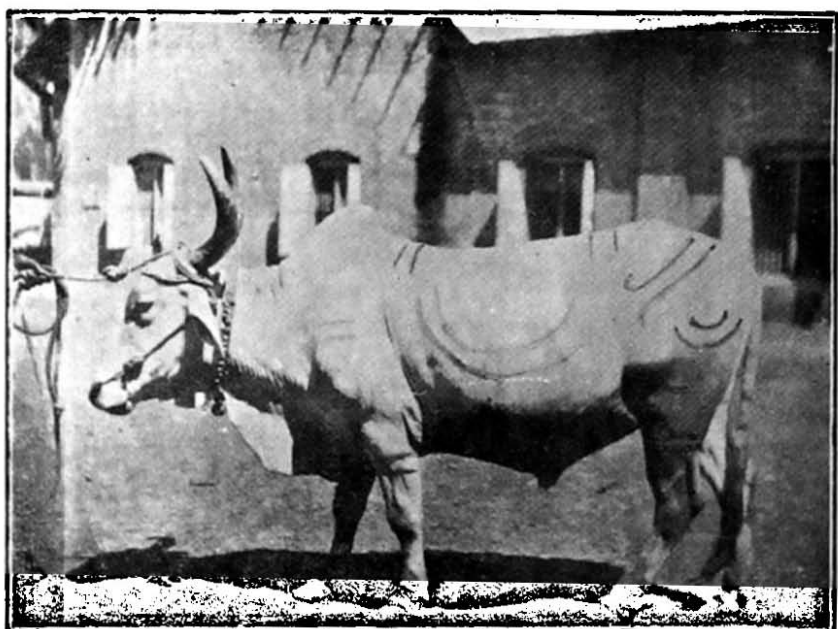


PLATE NO. 3.

hides do not come into the hands of the export tanners but are either tanned by the Dhori or chrome method for local use. (See Chapter VII.)

The hides of animals that have died a natural death are usually removed from the animal by the village scavenger and are then dried by him and sold in the neighbouring shandy (weekly market) where they are bought by small hide merchants who in turn take it to other markets or sell directly to local tanners. Where, however, the cattle die in the neighbourhood of a tannery the scavenger will in most cases take the hide direct in the fresh condition to the nearest tannery. South Indian hides are on the whole exceedingly heavily branded and in many cases the brands are so extensive that the hide is worth little or nothing as the cost of tanning is often equivalent to the value of the tanned leather. Some years ago, the writer read a paper to agriculturists at the Agricultural College, Coimbatore, in which he pointed out the economic loss to the country on account of this branding. An important Zamindar, who was present, in discussing the paper pointed out that with the present village system of South India branding, in his opinion, at any rate, was far from being the cause of economic loss. By the village system the carcass of the dead animal becomes the property of the village scavenger, although the animal when alive belonged to some ryot, and the income of the village scavenger depends considerably on the number of animals that die during the year. Unfortunately in many cases the village scavenger is not above increasing his income by the judicious use of poison and naturally chooses animals, for whose hides he will get a good value. This Zamindar stated that his own experience showed that unbranded animals had a considerably less chance of old age than heavily branded ones and that under these conditions he considered it economically sound to brand all his cattle sufficiently to make the hide valueless, as by doing this he was more or less insured from having his animals poisoned. The illustration shows a very normal branding, the animal illustrated belonging to a Madras tanner. The great majority of animals that die are either old or are suffering from some disease with the result their hides are poor in quality and in many cases are badly thorn scratched, or otherwise damaged, as is natural with animals that have had a long and hard struggle for existence. Practically no South Indian hides are exported in the raw condition, on the other hand, South India imports very large numbers of hides from other parts of India, the chief classes imported being dried hides (sukhi) from Cawnpore and Calcutta, dry salted hides from Dacca and Calcutta and arsenicated hide from Agra and Cawnpore. Rangoon hides are received chiefly in the wet salted condition. It is impossible here to describe the faults and damages of hides from other parts of India as the subject is far too big for a book of this scope. Considerable information, however, on the subject can be found in the report of the Hide Cess Enquiry Committee 1929-30. Normally, the Madras tanner can only purchase poor quality of hides from other parts of India as the demand for export is always greatest for the better

quality hides with the result that the difference in price between the different qualities of raw stock is very much greater than between the different qualities of tanned hides as can be seen from the following examples.

Statement showing cost of leather made from different classes of dry hides from Northern India and to what class of leather in Madras it corresponds (November 1929).

Class.*	Price * (per 82 lb.).	Per centage of leather expected.	Cost of raw hide for 1 lb. leather.	Cost of railway freight, tannage, etc.
(1)	(2)	(3)	(4)	(5)
<i>Framed.</i>				
Purab Agra slaughtered ...	75-80	105	13'9-14'8	5'5
Hubli selections ...	60-62	105	11'2-11'6	5'5
Mixed Purab ...	52-56	100	10'1-10'9	5'5
Dead framed ...	45-46	100	8'8-9	5'5
Rejects ...	38-39	95	6'8-7'8	5'5
<i>Unframed.</i>				
Chauri Chaura ...	38-39	95	7'8-8	5'5
Desi ...	35-36	90	7'6-7'8	5'5
Rejects ...	20-25	90	4'3-5'4	5'5

Class.*	Cost of leather produced.	Remark or equivalent in Madras. Tanned hide value at the same period. Price of prime regular raw parcels As. 15-6.† (7)
(6)	(7)	
<i>Framed.</i>		
Purab Agra slaughtered ...	19'4-20'3	} No equivalent price of highest quality. } Madras tanned being 16-5 annas. From prime regular raw to prime seconds.
Hubli selections ...	16'7-17'1	
Mixed Purab ...	15'6-16'4	
Dead framed ...	14'3-14'5	Equivalent to 'prime' fourths or 'best' regular run.
Rejects ...	12'3-13'3	Below fourths.
<i>Unframed.</i>		
Chauri Chaura ...	13'3-13'5	Prime 'fifths' or 'best' fourths.
Desi ...	13'1-13'3	Just below 'Prime' fifths or 'best' fourths.
Rejects ...	9'3-10'3	Between fifths and rejects.

* Volume. II, Hides Cess Enquiry Committee Report, pages 295 and 296.

† Taken from books of exporting firms of same date.

Skins.—Although the number of goat and sheep skins slaughtered in the municipal slaughter-houses in South India is very much greater than that of cattle, the number available from this source is still quite small when compared with the number actually tanned. When, however, we consider that over 90 per cent of the population of India is rural, it can be seen that although only a few sheep or goat may be slaughtered in each village that the number of these is very large when collected. Skins slaughtered in the villages are usually salted and then taken to the various weekly shandies where they are purchased direct by tanners or by local skin merchants who send them on to tanneries. In certain districts certain firms of skin merchants have an extraordinarily efficient and wide-spread system of purchase and have in many cases advanced considerable

sums of money to the butchers in both towns and villages with the result that they have the first call on all skins produced. In some cases they even provide the salt for curing and consequently are able to demand the type of curing they find most suitable. In Madras City both sheep and goat skins are taken directly from the slaughter-houses to the tanneries without any salting and are immediately put into work. Elsewhere where tanneries exist near fairly large slaughter-houses it is almost universal to salt the skins before tanning them. In almost all cases skins are removed from the animals in the bag form, that is, the opening is made from the tail down the two hind legs and then the skin is peeled off over the rest of the body in the same way that a stocking is removed from the leg. In many cases little trouble is taken to keep the skins free from blood and other dirt, but in certain slaughter-houses considerable pains are taken in this, and where this is done, as for example in Madura, the skins are always more sought after by the tanners, as they are free from blood stains and other damage. Practically all South Indian skins are salted with ordinary marine salt which is ground to powder before use. In a few cases Khari salt is used. In most places the butcher buys the animals and sells the skins after slaughtering but in Madras skins are purchased on the live animal in the same way described when writing of Bangalore hides. Here again there is no reason why the butcher should take care of the skin and consequently many of the skins are allowed to become dirty and covered with blood which may lead to considerable trouble.

The great majority of skins produced in South India are from animals that have been slaughtered for food and consequently are from young animals which is quite different to the case of hides. The skins are therefore on the whole in quite good condition. There are, however, certain defects which are more or less common on South Indian skins the chief of which are—

- (1) During the rains a defect known as rain defect "Malai-adi" become very prevalent on skins and in some cases as many as 80 per cent or even more of the skins may be affected. This consists of a Pustule containing pus underneath the surface of the skin about the depth of the hair root which in some cases bursts leaving an opening in the grain layer or in other cases causes thickness in the skin which may lead to damage being done by the knife during the Elamgaram process. These spots are commonest on the back of the animal, being more so towards the neck end, than at the butt end and are seldom found in the shanks and belly. There is a difference of opinion amongst the tanners and shippers as to whether Malai-adi and Pouri Pouri are the same being only different stages of the same skin disease of the animal or whether they are quite different. A discussion on this question took place at a meeting held on 12th December 1931, an account of which may be found in the proceedings of the Indian Section I.S.L.T.C.

- (2) *Pox*.—This again is due to a skin disease but is not seasonal like the previous one. In this case the damage consists of circular thickenings of the skin which vary in size from quite small up to about the size of a silver two-anna piece. These spots may be found more or less all over the skin. The pustule is in this case lower in the skin substance than with Malai-adi.
- (3) *Brands*.—These are not common on skins but are occasionally found where animals have been lame and branded for medical reasons.
- (4) *Mange*.—Certain number of animals suffer from Mange. This is, however, not common except amongst the few animals that are allowed to grow old. It is most common amongst the skins of old female animals.
- (5) *Thorn holes*.—In districts where prickly-pear and babool are very common it is quite usual to find a certain number of thorns that have pierced the skin of the animal and remain in the skin even after the animal has been flayed. Many of these are worked out from the flesh side during the Elam-garam process but occasionally pieces, broken off on both sides, are found remaining in the finished skin. Where these are worked out of the skin a small hole is left which for certain work is a serious defect as it may give a dark coloured mark on dyeing.
- (6) In some districts there is an insect which leaves a hole in skins somewhat like a warble. Fortunately this is not common. As far as the writer knows, the identity of the insect causing this damage is not known.

Sheep skins.—The latest live-stock census of India shows that there are well over 12 million sheep in the Madras Presidency which is about one-third of the total of the whole of India. In addition to this there are in the neighbouring States of Mysore, Hyderabad, Travancore, and Cochin. As South Indian tanners normally tans from 10 to 12 million sheep skins in the year, which is about 85 to 90 per cent of the total exported from India, it can be seen that considerable number of skins have to be imported from other parts of India to supply their requirements.

Most of the sheep in the southern districts are of the short red hair sheep type which gives very nice tight grained tanned skins averaging about five to six pounds for ten skins. The chief districts where these are common are Coimbatore, Trichinopoly, Madura, Salem, Ramnad and Tinnevely. But they are also considerable in all other districts south of Madras. As a rule, it can be considered that the quality of the leather from a sheep skin varies inversely as the value of the wool, and as these sheep do not have wool at all but only hair which is only of value as manure, it can be expected that the skin should give very good leather. This is the case as the leather from these skins is exceedingly nice being both tight of texture and having a very fine grain. North of Madras wool sheep become

very common and in the Ceded districts and the Hyderabad State there is practically nothing but small type of sheep with black wool. In all tracts between these two extremes various miscellaneous types are found some with wool of various colours others with white hair. In the Nilgiris and other areas of high altitude there are a few sheep of the long white wool type. As pointed out previously most of the meat-eating population of South India are mutton eaters so that the great majority of the sheep are bred for food and therefore slaughtered young with the result that skins have not had time to become poor in quality as is the case with local hides. If we take the average length of the life of a sheep in a mutton-eating tract as 2.8 years (Hide Cess Enquiry Report, page 219, Vol. III) South Indian sheep should yield 4 to $4\frac{1}{2}$ million skins annually, so that about the same number is required from other parts of India to make up the amount required. These are imported from all parts of India and vary considerably in type and nature. The largest number are perhaps imported from the Punjab most of which reach here as Paprya skins. These skins are the skins of long wool bearing sheep from which the wool has been plucked after a process of sweating and the skins have then been salted and dried for export to Madras. These skins are normally considerably heavier than the Madras skins giving in a yield of up to 8 pounds for 10 skins. They are, however, of much looser texture and generally of poorer quality. Practically the whole of the prime skins are made from the local hair sheep whilst most of the skins sent on commission to the London sales are of local origin. Tanned skins made from Papryas are chiefly exported to Japan and the East generally or are used in India a large number being sent to Calcutta. The export of tanned sheep skins as can be seen from the graphs in Chapter II has always been very much steadier than that of goat. Fluctuation in the demand for export in the raw state, which in normal times has never exceeded 10 to 15 per cent of those available for export, is insufficient to cause any marked difference on the number available for tanning. Madras tans over 85 per cent of the skins exported in the tanned condition. In addition to skins of Indian origin a certain number of imported skins are also tanned in Madras. For some years one of the largest skin tanneries in the immediate neighbourhood of Madras specialized on skins of foreign origin especially on Arabian skins which were imported into Bombay but brought from there to Madras for tanning.

Goat skins.—The goat population of the Madras Presidency is about 9 millions whilst the neighbouring States have about 3 millions. The average age at which goat is slaughtered has been worked out by the Veterinary department as somewhere about $3\frac{1}{2}$ years so that it can be expected that there will be a supply of about million skins, available from South Indian sources. Unlike sheep skins a large number of goat are exported in the raw state and although the proportion exported from Madras compared with that from other Presidencies, is very small, it is still considerable and amounts to from

one to two millions per annum. In the Madras Presidency it is the practice for certain skin merchants, who are in many cases tanners themselves, to select the raw goat on receipt and those of suitable sizes and weights are treated specially for export whilst the remainder are sent wet-salted to the local tanneries. Some similar procedure is carried out in other parts of India but in most of these cases the skins are dry salted as they have to be sent long distances to Madras.

As with sheep the goat skins from different districts show considerable difference, those from the south eastern districts are usually small and give very fine grained leather, whilst those from the Deccan are of a much larger type. Near Madras and from the Northern Circars a rather miscellaneous type is received varying often considerably in neighbouring districts. The character of the supplies from other parts of India depends chiefly on the nature of the demand for export, for instance, at one time exporters required only large skins and at that time Madras received a large number of small skins but few large ones, later on a demand for smaller type for export developed with the result that Madras received many more larger skins and fewer smaller ones. The quantity of goat skin tanned and exported varies from year to year much more than does that of sheep and this is not unexpected as it depends on the demand for export raw, which absorbs 50 to 70 per cent of the quantity available.

Avaram bark.—By far the most important of the tanning materials used in South India is the bark of *Cassia Auriculata* (Tamil—Avaram, Telugu—Tandagu, Hindustani—Tarwa): This shrub is fairly common through the greater part of South India, Deccan, Guzarat and Kathiawar, except in the Hills, but is not known in the United Provinces, Punjab and Bengal. The reason for the shrub not growing in the Punjab, etc., is, I believe, that although it is very hardy to heat and draught it does not stand frost well and even in South India it is not known on elevations of much above 3,000. It is most common in the Deccan. Hyderabad and Mysore produce very large quantities of it and export considerable quantities to Madras. Normally before the days of the export tanneries, the village tanner and his family cut the twigs and stripped the bark as they required it, but as tanneries got larger this has become an impossibility and there exists at present a very large trade in the collection and distribution of this bark. There are, however, places where village tanners still collect their own bark and use it as required. Usually the rights of collecting bark from Government lands are sold by the Tahsildar either annually or once in three years. But there is in addition to this a considerable supply from zamindari and privately owned lands. The stripping of avaram bark is an extremely tedious process as the shrub seldom has branches or twigs of more than $1\frac{1}{2}$ inch in diameter and it is much more usual that they are about $\frac{3}{4}$ inch. The bark is quite thin and only amounts when dried to about a tenth or even less of the weight of the sticks from which it is taken, that is, that quite a large headload of sticks will only give from 4 to 5 pounds of dried bark. It has always been found impossible to make the collection of the bark pay with full

time labour and it is only where there is a large amount of part time labour available that the collection of this bark becomes economical at a price comparable with other tanning materials.

If avaram sticks are cut and not stripped immediately they dry quite quickly, especially during hot weather, and when this takes place it becomes quite impossible to remove the bark as it then adheres tightly to the wood. This makes it practically impossible to work avaram bark at more than a short distance from the villages as if the sticks have to be brought in too long distances in the sun they dry sufficiently to make the work of stripping impossible or exceedingly difficult. The normal way of working avaram is that the men villagers cut headloads of sticks in the morning and bring them back to the village where the women strip off the bark during the day. This is done by placing the sticks on a flat stone and beating them with a piece of wood or stone so as to loosen the bark which is then removed by hand. During very dry weather the time sticks can be kept between being cut and stripped is very small indeed and hence little work can be done.

The value of the tanning material depends upon several qualities among which are strength, colour, class, tannin and the keeping and wearing properties of the leather produced. It is obviously impossible to take all these into account at one time when showing proportionate prices so that it is usual to reckon the value of tanned stuff according to its strength in the manner shown in the following table which was published by the writer in the *Mysore Economic Journal*, dated March 1915:—

Statement showing prices and values of various tanning materials in 1914.

Materials.	Average percentage of tanning by I.S.L.T.C. method.				Price per ton.	Price percentage ton.
	(1)	(2)	(3)	(4)		
<i>Materials used in England.</i>						
Sumach	25	£ 14 0	...	11 4	
Gambier	36	18 0	...	10 0	
Oak bark	9	4 1	...	9 0	
Oak wood extract	25	10 2	...	8 1	
Volonia	27	10 5	...	7 8	
Chestnut extract	28	10 10	...	7 6	
Pine bark	10	33 10	...	7 0	
Divi divi	28	9 16	...	7 0	
Mimosa bark (Wattle)	33	10 12	...	6 5	
Quebrecho wood	19	5 0	...	5 3	
Myrabolans	30	7 10	...	5 3	
<i>Materials used in India.</i>						
Avaram *	17	8 0	...	10 0	
Kutch	50	22 0	...	8 9	
Myrabolans	30	5 7	...	3 6	
Babool	12	1 17	...	3 1	

* Rs. 27 per candy.

It will be seen that even at that time avaram was exceedingly dear when compared with other commercial tanning materials. During and after War the price reached as high as Rs. 45 a candy as can be seen from the graph in Chapter II. When we consider that three pounds of avaram bark are used to tan one pound of leather it can be shown that the cost of the bark used in tanning one pound of leather is one anna for each ten rupees of the price of avaram bark per candy, i.e., if avaram bark costs Rs. 30 a candy the bark used for one pound of leather will be $30 \div 10$ or 3 annas; if Rs. 40, $40 \div 10$ or four annas. As other materials, for example, wattle bark will cost only about 1 to $1\frac{1}{2}$ annas it can be seen that it is uneconomical and impossible to use avaram except in cases where the leather produced has properties which will make up for the difference in cost; that is unless the leather produced is worth $1\frac{1}{2}$ to $2\frac{1}{2}$ annas more per pound than that produced by wattle, babool, etc., it cannot be economically used.

The Light Leather Federation in England in various letters to the Madras Government have pressed that every effort should be made to encourage the use of avaram for tanning instead of imported wattle or other materials but as the price offered by them for avaram tanned hides was only about one half penny more per pound than for wattle tanned, the South Indian tanner has been forced to give up its use for hides. For skins, however, it is still the chief material used, the reason for this being that the difference in quality in tanned skins causes very much greater difference in price. For instance, the difference between the same type of skin of prime tannage and of medium tannage is at least several pence so that it pays to use the material which gives the best result irrespective of the cost of it. It is extremely difficult to get accurate figures showing the amount of avaram bark collected in South India as in many parts it is delivered straight from the jungles to the tanners without coming by rail and in other cases it makes at least two journeys by rail so that railway figures have no value. It is however, possible to make an estimate of the amount of bark used by the Madras tanners as the amount of leather tanned is fairly accurately known and the amount of bark used for each pound of leather produced. This calculation was made by the writer for the Hide Cess Enquiry Committee and after being brought up to date is given in Table No.

Year.	Tanned hides		Tanned skins	
	(1)	(2)	(4)	(5)
AVERAGE.	TONS.	TONS.	TONS.	TONS.
1904-14	7,500 *	22,500	5,500†	13,700
1923-24	11,100	33,300	4,300	10,700
1924-25	10,900	32,700	5,300	13,200
1925-26	10,400	31,200	5,500	13,700
1926-27	9,800	29,400	6,000	15,000
1927-28	13,900	41,700	6,400	16,000
1928-29	14,800	44,400	6,100	15,200
1929-30	12,800	38,400	5,700	14,300
1930-31	10,700	32,100	5,500	13,800
1931-32	9,600	28,800	4,900	12,300

* At 3 lb.

† At $2\frac{1}{2}$ lb.

Year.	Total bark used.	Wattle import.	—	Local bark used. Net amount.
Average.	(6) Gross. TONS.	(7) TONS.	(8)	(9) TONS.
1904-14	36,200	...	...	36,200
1923-24	44,000	600 × 2½	1,400	43,000
1924-25	45,900	1,600 × 2½	4,400	41,500
1925-26	44,900	4,100 × 2½	11,200	33,700
1926-27	44,400	5,800 × 2½	15,900	28,500
1927-28	57,700	8,800 × 2½	24,200	33,500
1928-29	59,600	14,200 × 2½	39,000	20,400
1929-30	52,700	12,955 × 2½	35,600	17,100
1930-31	45,900	10,176 × 2½	28,000	17,900
1931-32	41,100	10,800 × 2½	29,700	11,400

NOTE.—To this must be added bark used on tanned hides and skins used in India estimated by the Leather Expert as 3,000 tons at present as against half this quantity pre-war or 8,000 tons bark as against 4,000 pre-war.

Many consultations have been held in Madras at different times to decide as to the best means of obtaining more of this bark at reasonable prices. But the large amount of labour necessary in stripping makes it impossible to work at in many parts of the country. An attempt was made in the Leather Trades Institute to design a machine that could do stripping and although this was satisfactory to a certain extent the outturn was much too small to make it a paying proposition, so that there is still an opening here for inventive genius that will help a cottage industry. If a simple light machine could be turned out that would do this work quickly the two claims (1) the agriculturist who requires the leaves and the twigs of the avaram bark for bedding and green manure, and (2) the tanner who requires the bark could be worked together. Normally when avaram is worked for bark the leaves and twigs are cut off and left in the jungle whilst if the shrub is cut for green manure the bark is wasted. Test experiments show that about 66 per cent of the shrub when cut is suitable for green manure. The balance being 27 per cent wood and 6 per cent bark which on drying gives 18 and 3 respectively.

Tanners of sheep skin are always willing to pay considerably more for quite freshly stripped bark than for that that has been stocked for some time with the result that there are violent fluctuations in the cost of this according to the availability of supplies. From graph No. 19 in chapter II, it can be seen that normally at the new year the price is rising and this rise continues until about March when it remains fairly steady at a maximum till the middle of June when it quickly falls till the end of July. It is normally the lowest during August, September and October, after which it rises again. The chief reasons for this regular rise and fall in price are (i) labour is very fully occupied in agricultural employment from November to March, (ii) the bark is difficult to strip during the exceedingly hot weather of April and May, but becomes more so after the first summer rains.

Bark of *Cassia fistula* (Tamil—Konam, Telugu—Rela, and Hindustani—Amaltas): Before the introduction of wattle bark, this bark was the only substitute used in any quantity for avaram. During times of scarcity it was largely used and regularly followed that of avaram being normally about two-thirds as much its price in Madras. As it only contains from 10 to 12 per cent, it is doubtful whether it is worth even this amount but had to be used when supplies of avaram are short. The supplies of Konam are of two types, one that from trees cut for timber where the forests are being worked and that from coppiced trees that are grown chiefly for the sake of the bark. This coppicing is carried out considerably in the Northern districts chiefly Vizianagram where there are considerable plantations worked on a regular routine. The cost of collecting the bark is considerably less than that of avaram as it is much heavier so that the labour employed in stripping is much less. The tannage is somewhat similar to avaram but duller and redder in colour. The Vizianagram tanners used to use this bark alone as it was relatively much cheaper there than was avaram. The other coast tanners also used considerable proportion of it along with avaram for the same reason. Elsewhere it was only used as a mixture or at a time when avaram was very expensive or not procurable. The demand for it and the production has decreased considerably since the introduction of wattle bark. It is however occasionally used mixed with wattle by some tanners considering that they get mellow and better leather from the mixture than from wattle only.

Wattle bark.—During the war when the demand for hides was at its height the amount of leather that could be tanned in South India depended on the amount of bark available and as avaram and konam bark became exceedingly expensive or scarce, other supplies were sought for and an experimental order for wattle was sent to South Africa. The bark on arrival was not at first bought by tanners but experiments were carried out in the Leather Trades Institute and a short bulletin based on this work was published by the Munitions Board explaining how best to use it as a part substitute for avaram. Copies of this bulletin are however now not available. A few tanners then made a success of its use and at the close of the war, kept on obtaining further supplies. During the slump of 1920-21, imports entirely dropped, but when trade increased, the imports again started and increased considerably until 1929 when practically the whole of the hides tanned were either entirely or chiefly wattle tanned. To begin with, a good deal of trouble was experienced by tanners and quite a lot of leather of very poor quality was turned out. This was almost invariably caused by tanners not believing that it was about three times as strong and astringent as avaram with the result that too large quantities were used, forming too strong liquors which causes case hardening. It was the export of these case hardened hides that caused the English customers to object to the use of wattle and the writer remembers being in the selection room of one of the largest users of Madras tanned kips in England when the selector was going through a consignment of Madras kips. Quite a large

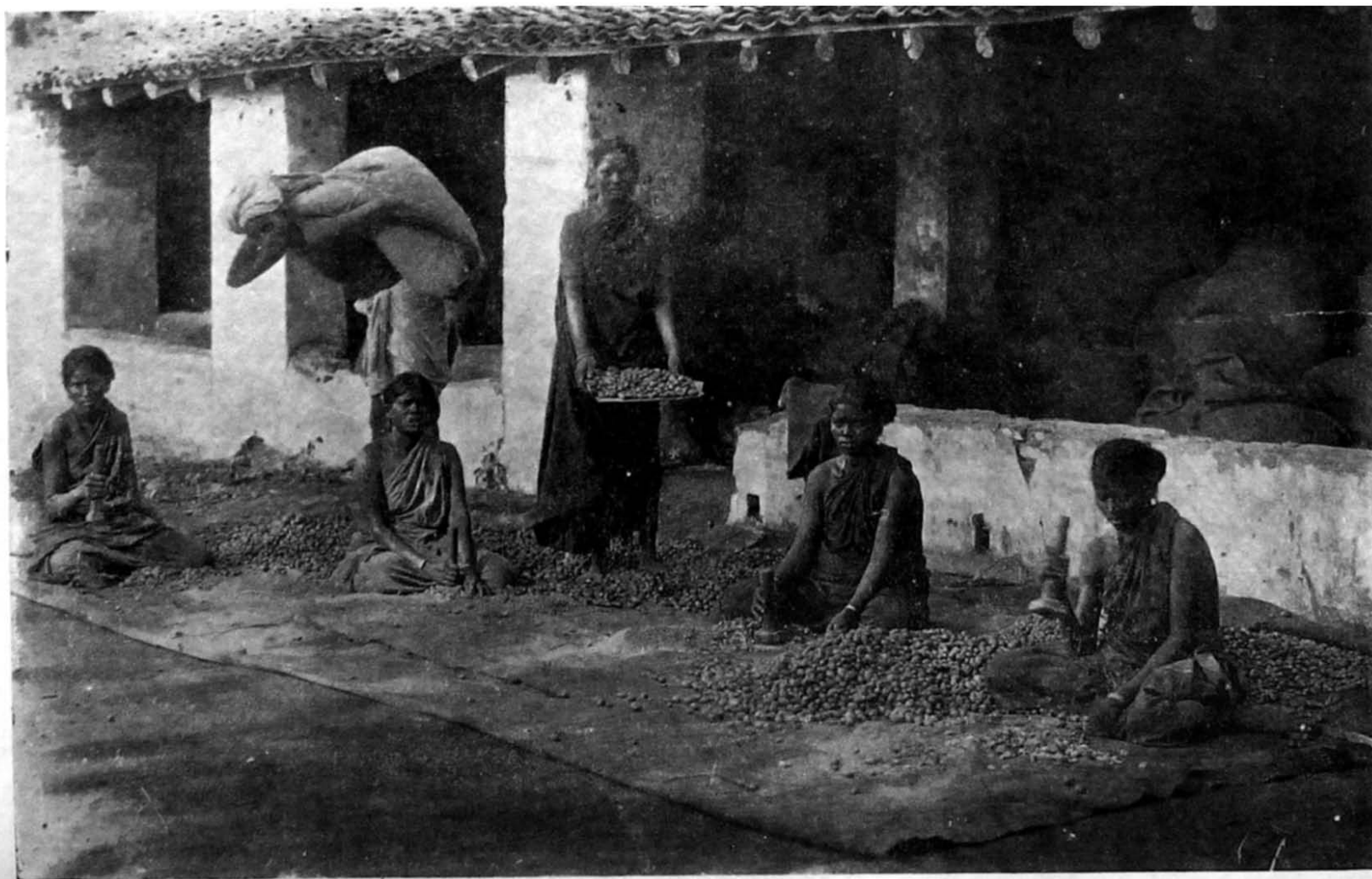


PLATE NO. 5 —SELECTING AND CRUSHING MYRABOLAM.

number of ordinary wattle tanned kips he referred to as "good old avaram tahnage" and pointed out the few case hardened ones as wattle tanned. There is no doubt at all that "the good old avaram tanned kips" were wattle tanned as the writer knew the tannery in which they have been tanned and they also showed the tell tale wattle stain on them. Wattle bark is imported chiefly in the chapped condition, in pressed bales bound with wire and covered with gunny. Being an article of world commerce and varying less on account of age than does avaram the price has always been much steadier than is avaram. A departmental bulletin dealing with this bark has been published and may be consulted if further information is required.

Myrabolams: The fruit of Terminalia Chebula.—The South Indian myrabolam, as a rule, is very much superior to that from other parts of the country, in that it is much stronger in tanning and gives a much lighter coloured impression. Practically the whole outturn is used in South Indian tanneries and none is exported as the local tanner is always willing to outbid the foreign competitor for this type of myrabolam. A large amount of work on the different qualities has been carried out in the Leather Trades Institute and also the Imperial Institute, London, all of which show the great superiority of these types. As pointed out in chapter III, on account of the light colour hot water may be used in extracting it, whereas with other types of myrabolams they tend to give duller coloured liquors. It is extremely difficult to give any estimate of the amount of South Indian myrabolams collected and used. On account of their high prices, there is always a certain import of cheap qualities from other parts of India so that the method employed under the heading "avaram bark" would be less accurate than for avaram. I should however estimate that the amount available is in the region of 3 to 4,000 tons per annum. The price of good quality of myrabolams varies considerably being highest when the demand for fine skins is greatest and less when commoner types are being bought more freely. Further details may be found in the departmental bulletin.

Waters.—The question of water-supply to the South Indian tanners is of immense importance, as regular supplies are essential and in addition the quality has a great deal to do with the success of the tannery. As is well known, there are few perennial rivers in South India with the result that practically all tanneries have to depend on wells for their supply of water and as it is usual that there is little rain in nine months of the year, there are few wells that yield a steady supply throughout the year. Water-supplies controlled by public authorities are usually insufficient to be used freely for industrial purposes, and where this is permitted the cost (usually over Rupee 1 per 1,000 gallons) is higher than tanners care to pay for water. Tanneries are also generally prohibited in municipal areas where these water-supplies are available. In most countries, there has been a tendency to increase the size of the tanneries, but in South India, generally speaking, this has been impossible as water-supply has been the limiting factor and at present very many tanneries have to reduce

the number of skins they put into work at certain seasons of the year on account of lack of water. A tannery in which the normal "Madras method" is employed uses about 75 to 100 gallons for each hide tanned and 15 to 25 gallons for each skin. Some tanners in order to prevent this enforced short working have excavated extra wells and there are now many tanneries with four or five wells, some of which are a considerable distance away from the tanneries. Not only does the water become short in supply during the dry weather but in many parts of the country there is a very definite seasonal change in the character of the water. In some cases the seasonal change is due to contamination of the well by the tannery effluent which finds its way back into the well. This of course is much more noticeable as the water level in the well sinks and as the supplies of water get less.

In practically all cases the water is drawn from the wells from bullock kavalais, but in a few cases, where there is power, pumps are used. Pumps on the whole have not been too satisfactory and in one or two cases where pumps were installed, they have been removed for one or other of the following reasons :—

- (i) The water-level in many wells varies well over 30 feet during the course of the year with the result any fixed pump will either be under the water when the water is high or will be too high above it when the water is low.
- (ii) Where tanners have four or five wells, it is evident that one pump would be of little use whereas the bullocks and the kavalai can work from different wells in rotation.
- (iii) Mechanical breakdowns of the pump may be very serious with skins or hides in the elangaram process whereas breakdowns of kavalais can, as a rule, be repaired in a very short time.
- (iv) Wells are often well away from the tannery.
- (v) The installation of power brings the tannery under the Factory Act, which is not popular with tanners.

Further details regarding South Indian waters may be found in Industries Departmental Bulletin No. 37 "Stains on Madras tanned hides and skins," No. 3. Note on South Indian tanning waters, which may be had from the Government Press priced 2 annas.

Lime.—In Madras and most of the other regions shell lime is commonly used. This varies very greatly in quality. It contains usually, when slaked about 40 per cent available lime. As the burning is usually done in small kilns and on a small scale, there is a great variation between the different samples and samples taken from different parts of the same consignment often show 60 per cent difference in their analysis. On the whole it is considered a mild lime and does not lead to excessive swelling. In other parts of the country local kankar lime is used and as it is normal for the tanners to burn their own lime, here again very great difference in quality is found from sample to sample.

Oil, gingelly or til.—The chief oil used in skins is gingelly which is fairly common in South India. Many tanners extract their own oil in order to be sure that there is no adulteration which is exceedingly common in oil bought in the bazaars. Several samples of gingelly and pungam oils analysed in the Leather Trades Institute, showed as much as 50 per cent added mineral oil and on this account, a simple test which can be carried out by any tanner has been published by the institute. This consists in soaking a little cotton lint with the oil and setting it on fire. Mineral oil is shown by smoke, whereas the vegetable oils burn with a practically smokeless flame. Til oil is exceedingly satisfactory for use as it is easily removed if necessary in the after processes.

Groundnut oil.—In a few places groundnut oil takes the place of til oil and if a good quality is used it is quite satisfactory. There is however a certain amount of doubt as to whether groundnut oil that has gone a little rancid or extracted from seed that has deteriorated slightly does not lead to a certain amount of “spew” in the leather when finished. This is at present being investigated, I understand, by the Leather Research Association in England.

Pungam oil.—Pungam oil is the chief oil used on tanned hides. It is considerably less costly than either gingelly or groundnut as it is not an edible oil and the leather trade is one of the few trades that can use it. It is produced very largely in the Bangalore district. Unfortunately it is very often adulterated with mineral oil as its colour and smell tend to make it difficult to recognize this. It is more viscosus than either til or gingelly and hence does not drip off leather when hung up, to the same extent as the other oils would.

Tanners oil.—The Burmah Shell Company supply a mineral oil for oiling off leather which is used chiefly in mixture with pungam oil and occasionally with gingelly and til oil. It is however chiefly used by the oil merchants as an adulterant to oils they sell to tanners.

CHAPTER IX.

Washing.

The first process that hides or skins undergo in the tannery is that of washing in water. In England and America this process is spoken of as ‘soaking’, but as the Tamil equivalent of this term is used not only for this process but for that of liming it may lead to confusion and hence in this book I have decided to use the word ‘washing’ for this purpose. Chatterton in his Monograph on Tanning and Working in Leather in the Madras Presidency wrote “The soaking pits are usually constructed below the ground level along the outer walls.” As it is the lime-pits that are usually below ground level the confusion in terms can easily be seen.

The chief objects of this process are threefold. (1) To bring the fibres of the skin into a condition similar to that in which these were when it was removed from the animal. (2) To get rid of all dirt adhering to the hair of flesh such as dung or blood. (3) To remove the materials added in the curing such as salt or khari salt. This is normally done by throwing the hides or skins into a pit and changing the water once or several times according to the type of the raw material. As washing entails the use of several changes of water whilst the goods only remain in the water for a short time, the pits in which it is done are almost invariably above ground level to allow of easy and quick draining. They are usually shallow not deeper than two feet so as to make the strain of lifting the goods into and out of the pits not great. The size of the washing pits varies very much from tannery to tannery and is in fact the most varied of the normal tannery equipment. In some cases they are uniform with the pits used for the elangaram process, but in others very different indeed and I know of tanneries where they are as large as 8' x 12' x 2' deep and others where they are only about 4' x 4' x 2'.

Fresh hides and skins from the slaughterhouse need only be left in water for a very short period with sufficient movement to expose all parts of the skin to the action of water so that all dirt may be removed. Two or three changes of water are quite sufficient to give the skins the necessary cleaning and make them ready to be taken forward to the lime.

The chief centre where fresh skins are tanned in the immediate neighbourhood of Madras City. During the hot weather, by the time the skins arrive in the tannery after the slow journey on the cart, they are often not absolutely fresh but are beginning to smell slightly and show signs of incipient putrefaction. In this case the use of small quantities of antiseptic in the first wash water has been found very advantageous. The most useful antiseptic for this purpose is chlorine, which being a very objectionable and poisonous gas must be used with great care. It can be brought compressed in steel cylinders and is used very largely in this form by the Madras and other Corporations for purifying the municipal water-supply. If used in this form a certain amount of apparatus is necessary in order to reduce the pressure and to dissolve the gas. Where only small quantities are required either bleaching power or perchloron may be used. Dissolved in water the chemically combined chlorine in these substances acts very similarly to an equivalent amount of free chlorine. Unfortunately, bleaching powder is not very stable and quickly loses its strength so that for normal tannery use, I consider perchloron the most satisfactory. This body acts as if it contained an equivalent of about 70 per cent chlorine as against 40 in fresh bleaching powder and will keep a considerable time without deterioration. The amount necessary to prevent further putrefaction is very small. One or two parts of chlorine per 100,000 parts of water is usually quite sufficient to give definite beneficial

results. Where perchloron is used, this means $1\frac{1}{2}$ to 3 ounces of perchloron for each 100 cubic feet of water or for a pit 6' \times 6' \times 2' one to two ounces only is required. With bleaching powder, roughly double this quantity is necessary.

Wet salted goods.—Wet salted hides and skins are usually washed for longer periods and in more changes of water, the time necessary being from two to six hours depending chiefly on the age of the skin and the temperature of the water. Longer and more thorough soaking is necessary than with fresh skin as the fibres which have been partially dehydrated by the cure must be brought back to the original condition and curing material should be removed. Normally, these skins are put into water early in the morning and are left for 2 to 3 hours in the first water, then trampled and lifted into a pit of clean water or on to the edge of the pit whilst the water is changed. In some tanneries the goods are removed from the first water into a second almost immediately. This however is a mistake and leads to definite loss of weight in the tanned skins. In cases where the skins are put into work in the bag form, they are opened out at this state. Great care is necessary in the cutting open of the skins as any deviation from the centre line of the belly or any irregularity in opening up of the front legs leads to bad pattern in the finished skin. Skins are then given two or three changes of water being moved by trampling and are then ready for liming. In some cases, the skins or hides are worked over the beam by scraping on the flesh side with a fleshing knife and at the same time any large pieces of flesh are removed by the worker. This working is very advantageous in cases where skins or hides become dry in parts when the workmen can then use slightly more pressure on these hardened parts and so help to soften them. - As with fresh skins, the use of a small quantity of chlorine is recommended where skins are not in perfectly good condition and in very hot weather. The quantities mentioned for fresh skins can also be used in this case.

Dry salted goods.—Dry salted goods need to be kept longer in the first water in order that the fibres which have been thoroughly dehydrated by the action of the salt and of drying may absorb water and come back to their normal condition. In these cases leaving them in water over night is the normal process, the after-treatment being similar to that for wet salted goods. A considerable amount of very valuable work on the soaking of dry salted skins has been published by McLaughlin and his fellow workers in the Journal of the American Leather Chemists Association during the last ten years. One of the chief facts shown was that in order to keep down the solution of valuable hide and skin substance to a minimum, the softening of the skin should take place in as concentrated a solution of salt as possible and that it is unwise to change the water too early or too often. It therefore follows, that the skins should be put into just sufficient water to cover them as any excess considerably reduces the strength of the salt solution. The goods should also be left

in the original soak water until the softening is completed and goods are ready for working over the beam or trampling as the case may be. It is only after this mechanical work and when the goods are soft enough that they should be washed in other changes of water to remove the salt. A further important fact shown by these workers is that excessive quantities of water are both unnecessary and harmful at all stages of the washing process and that the quantity of water used should be the minimum necessary for the work required.

An experiment can easily be done to demonstrate how stronger salt solution prevent damages due to putrefaction. Take two similar small pieces of salted hide and put them into two similar vessels with equal quantities of water which should be just sufficient to cover them. (If preferred this experiment can be done on the two sides of the same hide instead of on a small piece). One should be left standing in the same water whilst the water of the other should be changed half a dozen times during the course of the day, being left standing overnight. On examining them the following day the piece of hide in the vessel where the water was changed several times will be found to be definitely putrid, will have lost all the hair, will smell exceedingly nastily, will be slimy and ragged; all of which are signs of "over soaking." The piece in the original water will be soft and undamaged and perhaps even free from hair slip although as this depends on the curing, it is not invariably the case.

Up till quite recently it is considered very necessary to remove the whole of the salt from skins in the soaks as there was an idea that any salt in the limes would cause less swelling and would slow down the liming process. Very many careful experiments have been made and it has been definitely proved that a small amount of salt in the limes is not only unobjectionable but advantageous. This will be dealt with in the next chapter.

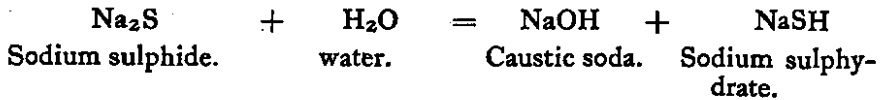
Dry goods.—Dry goods require still more severe treatment and it is necessary for them to remain longer in water as they do not absorb it as quickly as salted goods. European and American literature dealing with this process often mentions "soaking" of several days duration for this type of goods but on account of the much higher temperature in most Madras tanneries it seldom exceeds 24 to 36 hours at the most in South India, as longer periods would lead to considerable loss of weight if not actual visible putrefaction. To get a soft mellow leather such as is required for export, it is essential that the hides be brought into a thoroughly soft condition before going to the limes but as these are very putrefiable at this stage it is easy to see that considerable damage may result if the hides are left too long in water whereas if they are taken out too early other, though less apparent damage follows. In other parts of the world it is almost universal when soaking dry hides to add certain chemicals to the water in which they are placed in order to increase the speed of the water absorption and at the same time to slow down putrefaction. These chemicals are normally of alkaline or acid nature both

of which cause the hide substance to have a greater attraction for water and drink it in quicker. On the whole my experience shows that under Indian conditions the use of caustic soda is as good, if not better than most of the other materials recommended, many of which are considerably more costly. Caustic soda should be used at a strength of about one per thousand parts of water used, i.e., about 1 lb. for each 100 gallons of water or 1 oz. for each cubic foot. The amount of water should be just sufficient to comfortably cover the goods. This normally works out at about 10 lb. of caustic soda per 100 hides and costs somewhere about 2 pies per hide, but varies considerably according to the size of the pit and the crumpled condition of the raw hides. During the cold weather, it is quite possible and economical to use the caustic soda water for a second day by adding sufficient caustic soda to bring it up to its original strength. As this entails the chemical testing of the water it has seldom been done in South India. This amount of caustic soda is the amount that should be used with normally good quality water. If, however, the water becomes definitely milky on the addition of caustic soda, this shows that the water contains a considerable amount of temporary hardness which destroys an equivalent amount of caustic soda and consequently it is necessary to add further quantity in order to make up for this loss. In cases of this kind, the staff of the Leather Trades Institute, would always be willing to help any tanner who consults them regarding this matter. In the worst cases I have come across, it was necessary to add about two parts per thousand as the water contained sufficient hardness to destroy one part per thousand of caustic soda.

When using "chemicals" it must be remembered that they are seldom sold cent per cent pure and in many cases there is a choice of different qualities and strengths on the market. In making up solutions of various strengths this must be taken into account. Thus in the case of caustic soda it is possible to buy it in one of three forms—fused (76–77 per cent), flake (98–99 per cent) or powder (98–99 per cent). This means that 100 lb. of the fused material contains 76 lb. or 77 of the chemical and 100 lb. of the flake or powder 98 lb. or 99. Now if we require a certain quantity of the chemical—say 10 lb.—it will be necessary to weigh out $10 \times \frac{100}{76}$ or $13\frac{1}{4}$ lb.—of the fused or lb. $10 \times \frac{100}{98}$ or 10-1/5 lb. of the flake or powder. If the fused form is used it is very necessary that the workman, who breaks it and weighs it wears goggles lest a chip should fly into his eye and cause considerable injury.

• Sodium sulphide Na_2S has also been considerably used in the same process and gives quite satisfactory results but it is in my opinion slightly more costly and shows no great advantage over caustic soda. Roughly speaking, the action of weak solutions of sodium sulphide is the same as that of half the strength of caustic soda, as on solution sodium sulphide breaks up into two materials—

caustic soda and sodium sulphhydrate, the latter being of use in the unhairing but of little use in quickening the absorption of water by the hide.



Normally $1\frac{1}{2}$ to 3 per thousand of sodium sulphide is used as against one per thousand of caustic soda.

Commercial sodium sulphide is obtained in several forms the chief being fused and crystals. The fused form contains about 60 per cent of the chemical and the crystals about 37 per cent. Thus if 10 lb. of the chemical is required it is necessary to weigh out $10 \times \frac{100}{60}$ or 16-2/3 lb. of the fused and $10 \times \frac{100}{37}$ or 27 lb. of the crystal.

The use of the above chemicals is not at all experimental as they have been used by some of the largest and best known tanners in this Presidency and in other parts of India for years and it is only on account of the difficulty of getting into touch with tanners and their dislike of the use of chemicals that the use of either of these materials has not spread very much more than it has. Experiments carried out at the Leather Trades Institute during 1929 showed that the use of chlorine along with caustic soda is exceedingly useful. These experiments were unfortunately stopped before they were brought to a conclusion and it is therefore inadvisable to publish the results. The writer who was carrying them out was then informed by Government to confine his activities to the work on stains. As in other cases, the amount of chlorine necessary is very small and varies from about 2 to 4 oz. of perchloron for each pound of caustic soda used or double this amount of bleaching powder. Chlorine cannot be used with sodium sulphide as the two substances react forming inert bodies such as common salt that have little or no action.

Although acid soaks have been largely used in Europe and elsewhere, very little work has been done on this in South India and as the small scale experiments made in the Leather Trades Institute have not shown any great advantage over the use of caustic soda, it is not likely that the use of these materials will develop. Acids are as a rule more costly to transport and not so easy to deal with as the two alkalies mentioned above. Of the acids used in Europe, formic acid has perhaps given the greatest satisfaction. This body is difficult to pack for transport to the tropics and is not manufactured locally and it is unlikely to be used here on a larger scale at present. I have known of several cases where tanners in India have ordered formic acid from suppliers in Europe and although the latter have despatched the material, the tanners have only received the empty containers as the whole of the acid had escaped during the voyage.

Some sort of mechanical work is of very great assistance in the soaking of dry hides after they have become soft enough to bear this without damage. In South India it is usual to throw hides over a fleshing beam and scrape and stretch them with fleshing knife on the flesh side. The idea underlying this working is to open out the fibres by breaking down the adhesion caused by drying so that the water penetrates quicker. In Europe and in large factories this working is more often done mechanically in open sided or other types of drums where the partially softened hides are run with only a small quantity of water and so by their own weight receive considerable milling. The hand work, although not so efficient from a mechanical point of view, has one great advantage over the drum in that workmen noticing any large masses of flesh on the hide may remove it by a cutting stroke whereas this, of course, is not done in the drum. Even where a drum has been used I have known cases where it was found advisable to examine the hides after drumming and to pick out the fleshy ones which were then rough fleshed. After the mechanical working the hides should be left in water for about one to three hours so that the fibres which have been separated by the work may have the opportunity of taking up water and becoming fully hydrated.

It is exceedingly difficult to give any rules by which it is possible to tell when the washing process should be stopped. McLaughlin has however shown in the Journal of the American Leather Chemists Association that generally speaking, goods should remain in water with or without chemical addition as long as they are increasing in weight, i.e., taking up water. As soon as the weight begins to fall, it shows that putrefaction is starting and damage and loss of weight occurring. By this means it is often possible to tell in which of the two tanneries tanning the same type of material, washing is being done most efficiently as where the ratio of wet weight to dry weight is greater, the work is better. The weighing of wet goods needs considerable care and experience to get regular results but can be done satisfactorily after a few trials with hides. In the case of skins, it is however very much more difficult to get accurate results on account of the irregular quantities of water and the large amount of hair on the skins. The table below shows how the weight of two types of dry salted hide varied during the washing process and it will be seen that this increased to a maximum, then either remained constant for a short time and afterwards or fell straight away.

—	Time of soaking.	Weight of class 1.	Weight of class 2.
	HOURS.	LB.	LB.
Original weight of each class was lb. 100.	2	119	116
Do.	4	124	127
Do.	6	129	128
Do.	8	128	132
Do.	10	133	132

	Time of soaking.	Weight of class 1.	Weight of class 2.
	HOURS.	LB.	LB.
Original weight of each class was lb. 100.	12	134	126
Do.	14	138	128
Do.	16	134	129
Do.	18	127	124
Do.	20	123	124

This shows that the best time to soak class 1 was 14 hours and class 2 was 8 to 10 hours. Class 1 was a hide that has been imported from abroad, whilst class 2 was one of local origin and hence would have been a much shorter period in cure and therefore might be expected to require less soaking.

References.

- (1) Procter's Principles of Leather Manufacture, Chapter XII, page 162, etc.
- (2) Department of Industries (Madras) Bulletin No. 57, 'Notes on South Indian Tannery Waters,' page 3.
- (3) George D. McLaughlin and Edwin R. Theis Jalca, 1923, page 353.

CHAPTER X.

Liming.

After the washing of the hides and skins, they have to be treated by some method which will loosen the hair so that it may be removed. The method employed in practice is that of liming which not only looses the hair but also swells up the flesh so that it can cut off with a suitable knife. Normally, hides or skins are placed in pits containing milk of lime and are left in them 7 to 20 days according to the nature of the skin and the type of the tannage done. The pits in which the liming is done are invariably below ground level. During the course of the process the liquor is changed only once or twice so that the labour involved in lifting the water is not great. Where the pits are above ground level, there is always the danger of the water leaking out and causing extensive damage to the skins. In almost all cases, arrangements are made so that the old liquor (when thrown out from one pit) can be discharged either straight into the drain or run back into any other pit where it is required. The pits vary in size in different tanneries, but usually are about 4 feet square in skin tanneries and 6 feet square in hides tanneries. In some cases, tanneries that had originally been built for skins are now being used for hides so that the hides have to be limed in the 4 feet pits, resulting increases whose marks cannot be entirely removed by setting out.



PLATE NO. 6.—SKINS IN LIME PITS.

It is usual for the lime liquor to be prepared either the day before it is required or whilst the skins or hides are being washed and softened. A suitable quantity of water is run into the pit to which may be added a greater or less quantity of used lime liquor. To this water a suitable quantity of lime is added, care being taken that only the finely divided particles are added, all coarse material being rejected. This is a wise precaution as the larger particles often contain sand, unburnt shells and other materials that may cause scratches. At any rate when this waste material is put into the pit it becomes much more difficult to mix the lime liquor thoroughly when handling the goods owing to the solid mass it forms at the bottom of the pit. The normal method is to put the slacked lime or lime slab into a loosely woven basket and to agitate this with a circular motion partially immersed in the water until the finely divided lime has passed through the basket leaving the coarser matter behind. When the goods are ready to be put into the pit, this liquor is thoroughly stirred by the workmen stirring up the water with their feet and scraping the bottom of the pit with a mamti. The first time the skins are put into the lime liquor, it is normal to pass them one by one backwards and forwards through the milk of lime to ensure penetration of the lime liquor amongst the hair or wool. After the hair or wool is saturated with lime liquor the skins are piled in different corners of the pit. In some tanneries, this method of handling the skins is done each time they are put back, but in most tanneries, after the first time, they are simply thrown back and pressed down. Hides are usually thrown straight into the pit and pressed down by the workmen standing on them. Goods are removed from the pit daily and the lime stirred well. This 'handling' is done by labourers getting into the pits and removing the skins or hides with their hands on to the dividing walls and on the back and front of the pit. This method is peculiar to Madras as in other parts of the world the goods are removed with tongs, hooks or other mechanical means. In cold climates, it would be impossible for men to carry out the work as is done in Madras as the sharpness of lime water increases as the temperature gets less. When the hair is loosened enough, usually after 7 to 10 days, the goods are removed and unhaired and the skin or hide then returned into a new lime liquor for a further few days. At this stage the goods quickly swell up considerably and after 4 to 6 days are ready for fleshing. The amount of lime used in different tanneries varies very considerably depending on the quality of lime and the liming required. Normally the amount is about $1\frac{1}{2}$ lb. of lime slab or just under 1 lb. of dry shell lime per skin and about 5 to 6 times this amount per hide.

Fortunately for the tanner, lime is only slightly soluble and any excess added does no harm to the skins or hides but only tends to fill up the pit. The amount of lime soluble in a definite volume of water is very small and unlike most other materials the amount soluble in hot water is less than in cold water. A number of tables

have been published showing the solubility of lime at different temperatures and the one given below is based on the determination made by the author when a student.

100 c.c. of saturated lime water at	5 C/ 41 F	contain	0.1350	gram. of Cao.
Do.	10 C/ 50 F	„	0.1342	„
Do.	15 C/ 59 F	„	0.1320	„
Do.	20 C/ 68 F	„	0.1293	„
Do.	25 C/ 77 F	„	0.1254	„
Do.	30 C/ 86 F	„	0.1219	„
Do.	35 C/ 95 F	„	0.1161	„
Do.	40 C/104 F	„	0.1119	„
Do.	50 C/122 F	„	0.0981	„
Do.	60 C/140 F	„	0.0879	„
Do.	70 C/158 F	„	0.0781	„
Do.	80 C/176 F	„	0.0740	„
Do.	90 C/194 F	„	0.0696	„
Do.	100 C/212 F	„	0.0597	„

This table gives the solubility of lime made from Italian marble. Lime from other materials may be very slightly more or less soluble than this, but as the variation is very small these figures may be taken as accurate enough for all ordinary work.

From this table it can be seen that the amount of lime actually soluble in water at temperatures common in Madras being only about $1\frac{1}{4}$ parts per thousand, the water in a pit $4' \times 4' \times 2'$ deep will only dissolve $4 \times 4 \times 2 \times 1\frac{1}{4}$ oz., or $2\frac{1}{2}$ lb. of lime. As skins which are put into a pit of this size will require much more lime than this amount, it can be seen that it is necessary not only to place them in a clear saturated lime water but to have an excess of lime present. The water from which the lime is removed by the skins is then able to recover its strength from the excess of lime present in the pit and so to pass on the lime to the hide or skin. Adding large quantities of lime to the water in the pit does not increase the strength of the solution but only makes it possible for the hides to go on absorbing lime for a longer period.

If we take a piece of freshly slaughtered hide, carefully wash it in water containing two parts of chlorine per 100,000 parts of water, in order to prevent putrefaction starting, and then put it into milk of lime, the hide will swell up become firmer and increases considerably in weight. There however will be very little action on the hair which will remain firm for a considerable period. If after a certain number of days this piece is removed and another similar piece placed in the same liquor, it will be noticed that there is less swelling action but that the loosening of the hair takes place in less time. If fresh pieces of hide are again and again added there will finally come a time when the swelling will be negligible but the hair will be removed very quickly. The lime liquor which originally was odourless and white will during the course of these experiments have become highly charged with ammonia and other similar bodies

and will have a strong smell, whilst its colour will have changed considerably. If the pieces of hide used in this experiment are delimed and tanned, the first will be found to give a fairly heavy and firm leather, whilst each of the following samples will show less weight and greater softness. This shows that the chief property of a new lime is that of swelling up the hide or skin whilst it has very little unhairing action. On the other hand old limes have a strong unhairing action but cause much less swelling than does a new one. By carefully regulating the use of the lime liquor from this principle, the tanner is enabled to vary his liming so as to get the most suitable results for his particular needs. As an example if a tanner finds that he has great difficulty in removing the short hairs the addition of less water and more old liquor in making up the first lime will most likely make the removal of this short hair much easier. On the other hand a tanner who finds his leather too loose and flabby can do much to overcome this by using a fresher lime.

The general practice in the West during recent years has been to shorten the process of liming by the addition of sodium sulphide and similar chemicals to the lime. By this means it is possible to loosen the hair and swell the hide very quickly thus saving the double process which is necessary with lime only. Up to the present, the use of sulphide has been very restricted in Southern India, the reasons for this being (i) that its use does not give any improvements to the particular types of leather tanned by the South Indian tanner for export and (ii) that its use necessitates protection of the worker as the solvent action of sulphide is just as great on the epidermis of living people as on that of the dead skins and consequently it is impossible for workmen to do the handling, unhairing, etc., as is at present done. In a few cases where tanners have sought help from the Leather Trades Institute on account of having lots of skins that would not unhair by normal means, due to some mistake having been made in the curing, the use of sodium sulphide has proved exceedingly useful. It has, however, been necessary to make arrangements for the protection of the workmen's hands and legs in these cases.

As pointed out above, the action of lime liquor varies according to whether it is old or new and practice has shown that it is advisable to first treat the goods in an old liquor and finish in a new. This is usually done here in two stages whereas in the West, it is often done in several stages by means of working the hides or skins through a series of pits instead of leaving them in the same pit throughout the process. The number of pits of this type through which a lot of hide passes is known as 'set' and is worked in such a way that the skins or hides are regularly passed forward into newer and newer liquors. For details of the method of working such a 'set' any book dealing with European and American method of tanning may be consulted, (e.g., *Manufacture of Leather*, by Bennett, Chapter 7).

At first sight it may be considered that the methods employed by the Madras tanner of putting the washed skin into a freshly made lime is very different from this. However, as skins washed at the temperature common here carry forward a very active bacterial growth and considerable quantities of putrifiable matter on which they can develop, even a fresh lime liquor very quickly becomes 'old'. In this way the normal unhairing lime after about five days, use may be considered to be old having developed considerable ammonia and having unhairing rather than swelling properties. The unhairing skins or hides on the other hand carry forward a much smaller bacterial growth and still less soluble matter on which these can thrive so that these swelling—or elangaram limes as they are spoken of here—show little alteration after several days.

At one time, it was considered very important that no salt should be permitted to enter the lime pits and consequently great care was taken to wash out all salts from the salted goods. Modern experience and experiments have, however, shown that a certain amount of salt in a lime liquor is not normally detrimental and in some cases may be actually useful. Salt undoubtedly stops swelling in tan liquors and in acid liquors generally and many tanners have been led by this to expect the same to take place in lime liquors which, however, is quite a different case as these are alkalies and not acid. Experiments have shown that there is normally a slightly greater swelling in lime liquors in which there is a small amount of salt than in those without salt.

The warm temperature of South Indian tanneries tends to increase the solvent action of lime liquor on hides and to cause the unhairing to be quicker but introduces several difficulties. Wood, one of the most careful British Chemists, states in his book "The Puring, Bating and Drenching of Skins" that a fully limed skin begins to dissolve at a temperature of about 82° F though partially and fully delimed once will stand a considerable higher temperature. This temperature is considerably below the normal summer temperature in most South Indian tanneries and consequently excessive liming and swelling must be avoided. This high temperature is undoubtedly one of the chief causes of the weakening of the grain of skin causing the scudding knife scratches (கத்திவாரை) so common in South Indian skins.

In the case of sheep skins having wool of a commercial value, it is wise to treat them in such a method that the wool is not damaged by immersion in the lime. The method most commonly used is that of painting the flesh side of the skin with a thick cream of lime then folding the skin flesh to flesh and leaving them in the pile overnight. The painting of the flesh side with lime is done much quicker than it can be described. Skins are piled flesh up, the workmen standing behind the pile seizes the hind shanks while another standing in front dips a short wool skin into a thick cream of lime and drops this on the top of the pile. The first workman now throws over the hind part of the top skin and by means of a pulling motion coats this with the cream of lime carried forward on

the short hair skin. The dipped skin is then dipped into the lime again so as to be ready for the next skin, the coated one being folded into a bundle in such a way that as little as possible of the wool comes in contact with the lime. These bundles are then piled overnight.

The following morning the wool although not loose enough to be removed with the knife, can be pulled out and this is normally done by women who hold the skin with their feet and pull out the wool either with their fingers and thumbs only or by gripping the wool between their thumbs and a small piece of wood. Whilst doing this the women keep the different coloured wool separate. Pulled wool of this type suffers little or no damage from the lime and is hence of much greater commercial value than limed wool which has lost the greater part of its strength and a considerable amount of the felting properties. This painting process is general in districts where wool sheep predominate, such as the Ceded Districts and Hyderabad. In the central districts both methods may be found in use, whilst in the southern section where only hair sheep are found practically all skins are limed in pits. After wool has been removed from the skins they are thrown into lime pits and undergo a similar though slightly shorter liming than do other skins.

I know of one tanner, who adds small quantities of sodium sulphide to the cream of lime used in this process as he considers he gets considerably better results than with lime only. He has, however, to supply his workmen with rubber gloves to protect their hand from the sulphide.

Both unhairing and fleshing are carried out by throwing the skin or hide over a beam and pushing or cutting off hair or flesh by means of a soft iron knife. The beams are made by splitting the lower few feet of a palmyra palm and smoothening the surface so as to make it semi circular in section. These beams are usually about three feet nine inches long and one foot six inches across at the top and three inches less at the bottom. The workmen support the beam at an angle—usually about 60° from the horizontal, which he finds most suitable to his size and method of work by placing a plank or bamboos tied together in a × (cross) form in hollow cut in the back. Plate No. 1 shows the differences in knives used for the different processes for skins and hides. The concave is the working edge in all cases and should approximately fit the curve of the beam.

Unhairing is done by first making a cushion of skins or hides over the beam and then throwing the skin or hide to be unhaired over the cushion and removing the hair by a pushing stroke. In cases where the hair or wool has a commercial value other than for manure it is usual that the different coloured hair or wool is separated. In some tanneries this is done by the workmen himself, whilst in others a woman stands in front of him and picks out the white and black wool as it is removed and places it on separate heaps.

Fleshing is done over the same beam but no other skins are used as a cushion as is done during unhairing. As skins normally have very little flesh on them and that present is much less firmly attached than on hides it is normally removed by a pushing stroke with the knife roughly at right angles to the surface of the skin, but where larger masses of flesh are found and with hides this has to be removed by a slicing out with the knife held practically parallel to the surface of the beam. The Madras hide fleshing knife gives a narrower stroke than does the English fleshing knife and hence has a smaller outturn. On the other hand workmen become proficient in its use in a shorter time, it can be used with ease by a smaller type of man and is less liable to cut into the substance of the hide at the centre of the stroke than is the English knife. The English knife unlike the Madras knife has two edges; cutting is done on the convex edge whilst the scraping is done on the concave.

Five South Indian export skin tanners have installed fleshing machines which they consider to give better results than hand work especially when working extra heavy skins.

References.

- (1) Journal of the Society of Chemical Industries, 1901, page 224, and Procter's Principles of Leather Manufacture, page 170.
- (2) Das and Dutt. Proceedings of the Indian Section of I.S.L.T.C., January 1930.
- (3) Procter's Principles of Leather Manufacture, Chapter XIV, page 211.

CHAPTER XI.

Elangaram.

When hides and skins have been fleshed there are still several processes which they must undergo before they are ready to be tanned, the chief of these being (1) the removal of the lime, (2) removal of the short hair, the broken off hair roots, broken down epidermis structure and pigment from the hair pores, (3) removal of the lime soap formed by the reaction of lime on the fatty matter in the skins and (4) the pulling down of the skin from the swollen condition in which it is, to the soft and pliable condition which is required to give a leather suitable for export. All this is done



during the elangaram process which consists in alternatively soaking the goods in water with or without movement and in working by means of a knife over the beam.

In Europe there is a saying that "leather is made in the bate house" and as the elangaram process includes the South Indian equivalent of bating, this saying is applicable to the elangaram process. As the character of the finished leather, particularly as regards feel and appearance, depends more on this process than any other the meaning of this saying can be easily understood.

Unfortunately, this process is scientifically one of the most difficult to understand and to control effectively as the process depends on very complicated bacterial, biochemical and chemical actions of bodies of which even the constitution is not thoroughly understood.

As skins or hides are washed in very many changes of water during this process it can be seen that quick drainage is essential and as in the case of washing, pits for this process are invariably built above ground level. They are usually not more than 2 feet 6 inches deep and vary from 5 feet to 8 feet square according to the size of the tannery and the amount of material worked. In large tanneries it is found handier to work in a number of smaller pits than in a smaller number of unduly large one.

The length of time the goods remain in this process and the number of workings depends on several factors such as the quality and the temperature of the water, the class of raw material being worked and the quality of the finished leather required. The time the goods remain in this process is normally from 30 to 96 hours whilst the number of washings runs from 8 to 20. Generally speaking, the primer the quality of the skins, the longer will they remain in process and more workings they will receive. The normal tanner judges the quality of the tannery water by its action in this process. The water in which the skins can be left a longer time without suffering damage is considered to be the better water. At present the elangaram process is very similar to that used in parts of France for the finest French kid and was almost certainly introduced originally from Lyon in France where it was then used in the calf kid industry calf kid was a very popular type of leather about the middle of the last century. Everything points to the fact that this process was introduced into the South India by DeSusa about 1850 and that it reached here via Mauritius where DeSusa is supposed to have learnt tanning methods.

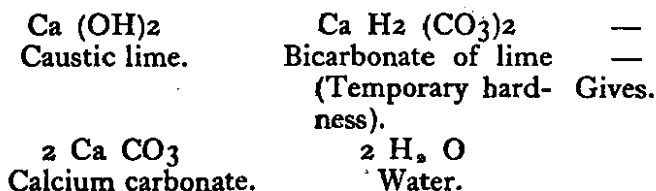
Lime cannot be removed from hide substance, for which it has a very great attraction, by merely washing in pure water. If a fully lime hide or skin is placed into pure water, a certain amount of lime will diffuse out into the water but if further lots of fresh water are added, the amount quickly lessens and however long and with whatever number of waters the washing is carried out a certain amount of lime still remains in the skin. This can be seen from

the following table and diagram taken from Chapter I of Wood's book — "Puering, bating and drenching of skins."

Lime removed from lime skins by washing in water.

	Time of washing.	Per cent Cao on dry skin.	Per cent lime removed.
Aa taken from lime	4.6	...
1 hour	3.05	34
2 hours	2.20	52
3 "	1.75	62
6 "	1.55	66
7 "	1.55	66
24 "	1.50	67

As however most tannery waters are far from pure, it is necessary not only to consider the action of water but also that of the soluble impurities contained in the water. If these will react with lime, it can be seen that although present in small quantities their effect may be very important on account of the large amount of water used. One of the commonest impurities in ordinary waters is temporary hardness which consists of bicarbonate of calcium or magnesium. Caustic lime reacts with temporary hardness forming an insoluble body calcium carbonate corresponding to unburnt lime stone or shell.



When calcium carbonate is produced by the reaction of the caustic lime in the hide substance some of it may remain mechanically held in the fibres of the hide or skin and this is often the cause of "water stains" which are the causes of very considerable trouble and damage in many tanneries.

The amount of water used in elangaram process is very large indeed and normally amounts to from two-thirds to three-fourths of that employed in the whole process. In this process it is not unusual for skins to pass through as many as 20 different lots of water. The amount used per skin or hide for each washing varying considerably in different tanneries but is normally $\frac{1}{2}$ to 1 gallon per skin and about 6 times this amount for hides. The following is one of the many methods employed by skin tanners. On the removal of the skins from the limes, they are washed by trampling in two lots of water and then fleshed "Salla" that is placed flesh side up over a beam and scraped with a fleshing knife so as to remove as much of flesh as possible. They are then washed again by trampling in two more waters and then are scudded "Khar." Scudding is done by placing the skin grain side up over the beam over which several skins have been stretched so as to act as a cushion. It is very important that the knife used for this purpose has a very clear

and even edge. After the first scudding they are again washed and then left over night in fresh water. The following day they receive a second fleshing and are again washed by trampling in two waters and then get the second scudding. After this they are washed twice in water and left over night. The following morning they receive a third fleshing followed by two more washings and finally one or two more scuddings with two washings and tramlings between each. In addition to this working, washing and trampling goat skins are usually given a certain amount of beating. This is done either with cylindrical wooden blocks fixed on to the end of bamboo about 6 feet in length or by the workmen feet. In the former case a line workmen stand on either side wall of the elangaram pit in which the skins are placed with just sufficient water to make them slide over one another easily. The beating is carried out in a regular and definite system, the time of each stroke being kept by means of a vocal effort by one of the workers or a maistri—which is repeated in turn by the whole of the men working. Where this is done with the workmen feet, the same number of men get into the pit at either side and whilst standing on one leg use the sole of the other foot as a hammer. In this case time is kept either vocally as with the beaters or by means of a drum—usually either on empty kerosene tin, bucket or upturned tanning tub. This beating is usually done after each of the last two scuddings, but the exact place where it is done and the severity of it varies considerably from tannery to tannery.

Each scudding is done in its own particular way and maistris and workmen know these by different names such as "ota khar" or "chapa khar" depending on the direction and method of scudding. As however the exact working of these different "khars" is not the same in different tanneries it is useless to try to describe this in detail here.

The first scudding is usually of a light nature and more or less in the direction of the hair. The second scudding is usually much severer and more prolonged, whilst the working is done not only in the direction of the hair but against it, and at every angle possible. The following scuddings may be more or less severe or slight according to the nature of the skins and the pulling down property of the water.

In my experience in South India I have only come across two or three waters which have been "too good" to give good results with the normal Madras method. In these cases it was necessary to add something such as acids to make it possible to completely remove the lime. One of these waters contained under five parts per one hundred thousand of total impurities of which only two parts consisted of temporary hardness. On the other hand I know of many waters which have no much temporary hardness that they destroy the caustic lime very rapidly and so allow the skin to fall very quickly and often give considerable trouble as this produces water stains. A lot of work has been done in the Leather Trades

Institute on the effect of different chemical impurities of water in this process, but there is still a very large scope for work on the bacterial and biochemical side of this question of which very little is known. Experiments have shown that it is impossible to get a good pulling down in a sterile water and a certain amount of bacterial action seems necessary. This is shown by the fact that if small quantities of chlorine are added to the water used in the elangaram process it is slowed down tremendously and does not yield the required result. The use of chlorine at this stage may be exceedingly useful in cases of any disorganisation which makes it imperative to keep the skins longer in this process than normal. The addition of small quantities of chlorine, say 2—10 parts per 100,000 will make it possible to keep the skins one or two days longer at this stage without any serious damage taking place.

As pointed out earlier the reaction between the caustic lime in the skin and the temporary hardness in the water is one of the chief causes of water stain "tani charai." To avoid these, as far as possible, care should be taken to never allow skins, whilst they contain caustic lime to remain any length of time without movement in water containing considerable quantities—say over 15 parts per 100,000 of temporary hardness. It is quite easy to test if a skin contains any caustic lime, by cutting it in a thick part and dropping on to the cut surface a little of phenol phthalein test solution ($\frac{1}{2}$ to 1 part of phenol phthalein dissolved in 100 parts of rectified spirit) which in the presence of caustic lime gives an intense red colouration. The absence of red colour does not indicate that the skin is free from all forms of lime and is ready to go forward to bark, but only that the caustic lime has been removed or transferred into some inert form. Thus limed skins washed in hard water several times without scudding would show no red (in certain cases a very light pink colour may be noted) but will contain considerable quantities of carbonate of lime. If this carbonate of lime is spread evenly throughout the skin little damage takes place, but if there are accumulation at certain places and none at other, stains are often produced.

Investigation has shown that the most pronounced water stains are usually produced when skins are thrown into fresh water containing a large amount of hardness immediately after fleshing. As at this stage the skin containing a large amount of caustic lime and as the fleshing process takes a considerable time, say often 2 or 3 hours to carry out, it can be seen that the first few skins fleshed and thrown into water often remain a long time without movement and to begin with at any rate are in a relatively very large quantity of water. This allows considerable action to take place between the lime in the most exposed portion and the impurities in the water. Where water contains over 20 parts hardness and in some cases with even less, I consider it is wise to return them into some of the same water in which they have been washed before they were fleshed, or into a mixture of this with a certain amount of fresh water, or fresh water

to which a suitable amount of clear lime water has been added. Only when the goods are all completely fleshed, should they be moved forward into fresh water and immediately well trampled so that the reaction will take place evenly throughout the goods and not in particular places only. The same precaution should be taken after the first scudding if any caustic lime is still present. In the same way before goods are left in the water overnight or during meal time, they should be kept in motion in the water in which they are to be left for some time so that the reaction between the hardness and caustic lime will be lessened and hence the chance of damage will be greatly reduced. In certain tanneries, where previously bad water stains were common, but where these precautions are now taken, water stains have been very considerably reduced if not completely got rid of. In most cases, the elangaram process and the delimiting is not carried out as thoroughly for hides as for skins and in some cases a certain amount of caustic lime is left in the thicker portions of the hides. Where avaram bark is used this is of little consequence as the bark contains sufficient non-tannin substances that on fermentation produces products of an acid type which will remove the lime. With wattle bark, however, the case is different as this produces very little acid and hence does not remove any lime left in the same way and this in some cases leads to irregular colour and stains.

McFarlane strongly recommends the use of bran drench for hides during elangaram process and under certain conditions it has been found to give much better colour and feel to the hides than where water alone has been used. It has also been used for skins in certain cases especially when water has been scarce and unsatisfactory. To make a bran drench, a suitable amount of wheat bran is placed in a tub and scalded with sufficient boiling water to completely cover it. The amount of bran used is often about 5 lb. for each 100 lb. of lime pelt but very much smaller and sometimes larger quantities are used under particular conditions. For use this solution is diluted down in sufficient water to completely cover the skins or hides to be treated. The action that takes place causes a considerable amount of gas to be evolved and at the same time produce a considerable amount of weak organic acids, chiefly acetic and lactic acid, which dissolve out the lime. The accumulation of the gas produced in the hides and skins cause them to rise to the surface and they must be pressed down every now and then to prevent those on the top being damaged by drying or by bacterial agency. This rising of the hide or skin to the surface is known to the English tanner as "working" of the bate and the number of times that they come to the top may be taken as a rough measurement of the amount of drenching that takes place.

During the last few years, the use of oxalic acid by skin tanneries has become fairly common. It is normally used some time during the second day and at a stage when all the caustic lime has been removed from the skin, but before the skin is thoroughly pulled down.

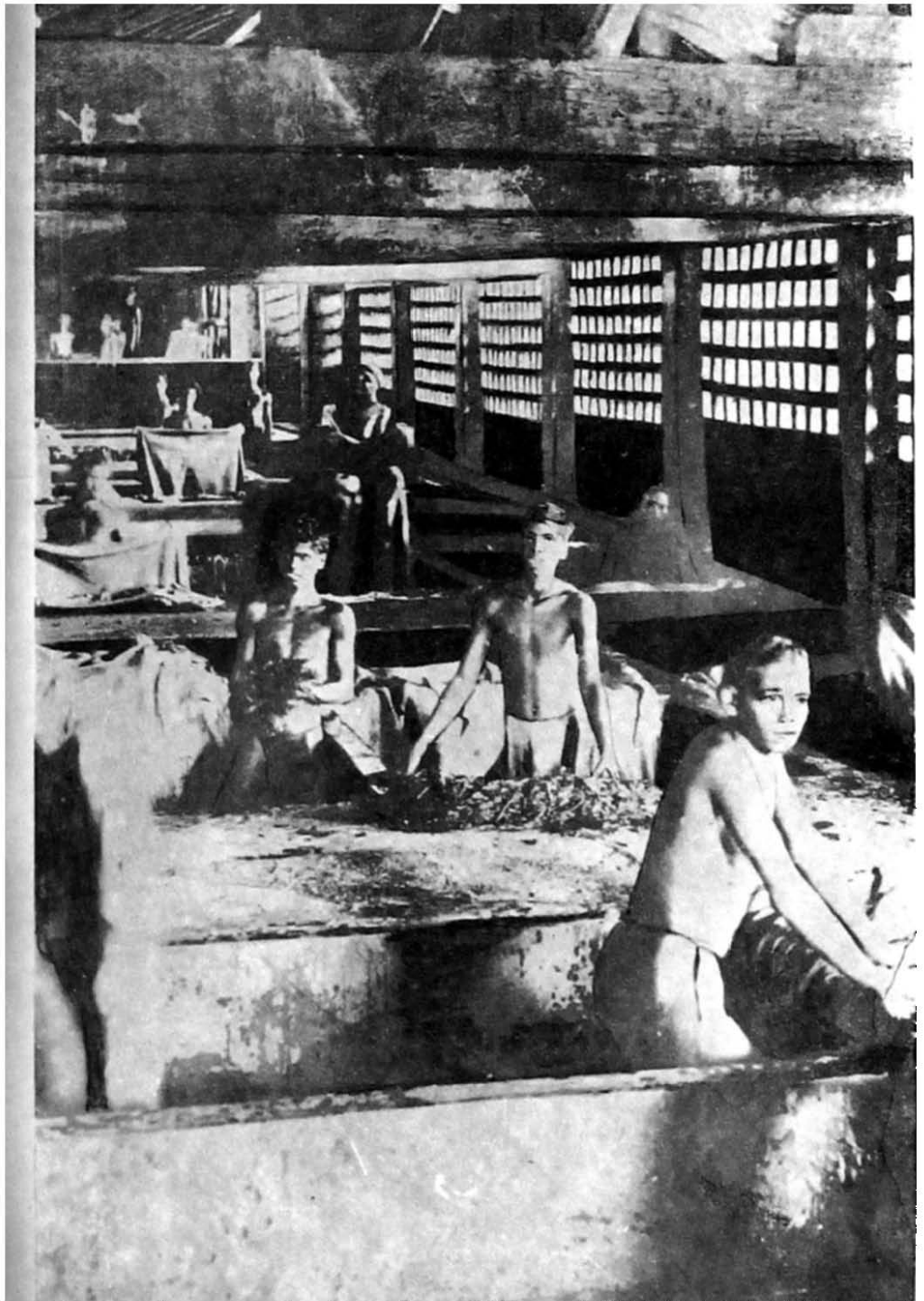
Oxalic acid is the strongest of the organic acids and is able to react with any calcium carbonate formed in the skin where some of the weaker organic acids and boric acid cannot do this. Oxalic acid forms with salts of lime a white insoluble body which however differs from carbonate of lime in that it has no action on tan liquor and hence even if mechanically carried forward by the skin does not cause stains. It should be used in just sufficient water for the skins to comfortably move over one another as the action required is a surface one. Many tanners who have previously got some slight water stains have found that the use of oxalic acid in this way has prevented the formation of these or made them very much less noticeable. The amount used varies very considerably but about half a pound per hundred skins is more often used than any other amount. It is important that the skins be kept in movement during the whole time they are in the oxalic acid solution and should be washed in fresh water immediately after this has been done. Boric acid has been used by a few tanners and is especially useful in cases where the water is too good to pull down the skins or to remove the lime from them. It is an exceedingly weak acid and does not remove calcium carbonate if previously formed.

CHAPTER XII. ✓

Tannage.

Up to this state of the process, all work done has been with the object of getting rid of those portions of the hide or skin, which are not wanted in leather formation and in bringing the portion required into the most suitable condition for the production of leather. The hide or skin is still 'raw' and of a very putrefactive nature so that any delay in the process at any point previous to this, with the exception of the time the hides or skins are in the lime pits, will lead to considerable damage due to putrefaction taking place. The next part of the process, that is, tanning, entirely changes the nature of the skin or hide turning the putrefiable skin substance into leather, which is exceedingly stable and resistant to decay and to all forms of organisms except mould. During this process also the jelly-like fibres of the skin or hide change in nature and lose their stickiness, so that on drying it does not become hornlike, as does the raw hide, but remains reasonably soft and pliable. The fibres also become more absorbent to oil or grease so that the application of this softens leather without giving it an oily feel.

The method of tannage used in South India is that known as the contact process. Hides and skins are brought together with the tanning material and water into pits or tubs so that the gradual transference of the tannin from the bark to the water and from the water to the hide or skin can take place. Up to the War, the barks used were always avaram (*Cassia auriculata*) and konam (*Cassia fistula*) but since the War, larger and larger quantities of imported wattle bark have been used for hides, as can be seen from the diagram in Chapter II.



As the processes used are still based on the avaram tanning, I shall first describe the normal avaram tannage of skins. The day before the skins are to complete the elangaram process, a tan liquor is prepared to receive them, by taking a clean old liquor, from which a previous lot of skins has been removed, and adding to it from 1 to 1½ lb. of bark for each pound of leather expected. This is allowed to soak for 24 hours or more in the liquor before the skins are brought into it. The bark liquor thus prepared is known as the 'Medichal.'

Great care is always taken to remove, as far as possible, all extraneous matter from the bark by first of all sieving it and rejecting the fine material that passed through the sieve. This contains a good deal of earthy matter, sand, etc. When the bark comes from a red soil or laterite district, the earthy matter may contain a good deal of iron, which, if left in, would tend to cause discoloration and stains. The dust removed from the bark is not wasted, but is usually sold to village tanners who use it to tan pieces or bad rejection hides and skins. It normally contains about 12 per cent of tannin but gives a liquor very much higher in colour than does the rest of the bark. After sieving, the bark is put quickly into water, stirred up for a few seconds and then put into another one to three waters. After remaining a few seconds in each of these, it is removed and drained and then taken to the pits or tubs into which it is to be used. This washing tends to further clean the bark as large stones that have not been removed by the sieves immediately sink to the bottom and are hence not carried forward whilst a good deal of dust is also washed off the bark which leaves it much cleaner for use and consequently gives a brighter coloured liquor. There is, in this process, undoubtedly a definite loss of tannin, but as the colour of the leather, at any rate in the case of skins, is an extremely important matter to the South Indian tanner, it is worth while carrying out this process thoroughly as the gain in colour and quality far exceeds the loss. During the 24 hours that the bark remains in the liquor, it is stirred up several times.

When the elangaram process is complete, skins are brought to the tannery by the elangaram labourers and are immersed in the tubs or pits by quickly drawing them one by one backwards and forwards through the liquor and then pressing them down. Whilst doing this, the workmen count the skins so that the pre-arranged number is placed in each pit or tub. The normal number of skins put into a tub 3 feet 6 inches in diameter is about 50 and about 4 for each cubic foot of liquor in pits. Almost immediately the boys or men engaged in handling the goods in the tannery remove these skins, again checking the number in each tub or pit, and pile them on the edge of the pit or over the sides of two tubs. Care is taken so that no part of the skin touches the outside of the tub and does not come in contact with the hoop iron with which the tubs are bound. When all skins have been removed, the bark and liquor are stirred up and the skins replaced in the liquor often being paired grain to grain

so that the absorption of the tannin from the grain side is slow whilst much more is absorbed by the flesh. This tends to an evener and lighter colour on the finished skins. Each pair of skins is pulled backwards and forwards through the liquor and is then immersed. A second similar handling may be given after one or two hours and the skins are then left in the liquor overnight. The following day, the skins receive two further handlings and on the morning of the third day are removed from the pit and given the first bark working.

The bark working consists in first squeezing as much water from the skin as possible and then working them on the flesh side with the fleshing knife. The squeezing is done by placing 3 or 4 skins together and passing one of the hind shanks of all skins over a fixed beam and turning these into the folds of the skin which is then twisted by the workmen's hands, thus getting rid of the greater part of the water held on the surface or between the fibres of the skin. The same process is carried out with hides except that a second bamboo is placed in the same way in the opposite front shank and the hide twisted by means of this either by using a fixed bamboo as a lever or by having a second man sitting on the bamboo so as to give an extra weight to it. In some tanneries, a number of skins or hides are twisted into a kind of rope and then twisted from the ends in a similar way. The knife work should be done in such a way that the pattern of the skin will be as square as possible and also so as to give as large an area as possible. Although skins and hides are sold by weight, the buyer almost always sells them by area (R.F.) and so when he buys considers the area more than the weight. The best method of working is to first work lengthwise from the centre lightly to the tail and heavily along the ridge to neck end and then working from the ridge to the shanks and belly, great care being taken to get the greatest stretch possible out at the neck end. During recent years there has been a great improvement in the pattern of the skins from many tanneries. In certain cases, however, the cross working is now only being done with the result that the skins become much broader than they are long. Too great breadths without corresponding length is just as bad as too great a length without breadth and as this cross working often leads to creases being formed in the skin, running from the ridge about the shoulder to the front shank, which after drying can never be removed, the lengthwise working should never be altogether omitted.

After this working, the skins are replaced in the tan liquor, but the bark which has previously been lying at the bottom of the tub is now placed between each skin so that the feeding of the skin is now much quicker and evener. The skins are handled daily for another four days by which time the greater part of the tannin will have been transferred from the bark to the skin and the liquor will show very little strength. The skins are therefore removed and are then given a second bark working which is similar to the first.

Immediately the skins are removed from the tubs, the spent bark is thrown out and the liquor allowed to stand for some time so that any sediment may settle to the bottom. The clear liquor from the tub is now removed either by means of buckets or small tubs or by a syphon and is put into another tub. The amount removed varies considerably in different tanneries. But it is usually somewhere about two thirds. The balance which contains a large amount of sediment is thrown out. Water is now added to bring up the volume to the required amount and from $\frac{3}{4}$ to $1\frac{1}{2}$ lb. of bark per pound of leather expected is added and allowed to soak. This bark has previously been sieved and washed as mentioned in dealing with the first bark liquor. After the skins have been worked, they are placed into this liquor, usually being left without any bark between them every night, and the following morning are handled and bark placed between the skins. They are handled in this liquor daily for about one week and are then removed for a third bark working.

By this time all except the very heavy skins are tanned through and are ready to be given the myrabolam bath which follows. The heavier goods are sometimes given an extra bark liquor and an extra working. The total amount of bark given usually works out at about 3 lb. for each lb. of leather produced, i.e., for skins weighing 6 lb. per ten about 17 to 18 lb. of bark will be required for each ten skins.

When goods are finally removed from the bark liquors and are being worked out as previously mentioned, a myrabolam bath is prepared by soaking a suitable quantity of myrabolams (usually less than $\frac{1}{4}$ lb. for each lb. of leather expected) in boiled water and diluting down with sufficient water to cover the skins.

Leather tanned with avaram bark is of a very light colour but on exposure to light and air, the colour quickly changes into an objectionable brick-red. This change of colour is not peculiar to leather tanned with avaram but is common to that tanned with many barks of which wattle and konam are other examples. The tannin in these materials is of a similar chemical nature and belongs to a class which is called 'catechol,' from one of the materials produced if this is treated in a certain chemical way. Fortunately other tanning materials of another class—'pyrogallol' class, of which myrabolams is an example do not give this fault. If leather tanned with one of the first class is given a final bath in one or the other, this property of changing colour is considerably diminished particularly if this liquor is more astringent than the liquor in which it has previously been. On this account, all skins and hides tanned in Madras are put into a myrabolam liquor before being finished. It is believed that this process was first introduced by DeSouza who has previously been mentioned and who may be considered as the originator of the process used at present. It may be asked if it would not be advisable to give up the use of avaram altogether and to use only myrabolams in order to entirely avoid this change of colour. Unfortunately myrabolams and most other materials of the pyrogall

class if used alone give a very spongy leather which is both unsatisfactory in colour and feel and also does not finish or wear well, whereas leather tanned with avaram is much better in all these ways.

Macfarlane in his description of the work of the Government tannery at Bombay strongly recommends the soaking of the myrabolams in cold water (R.F.²) whilst in South India hot water is invariably used and tanners who have tried Macfarlane's proposals inform me that their results have never been in any way as good as when boiling water is used. This seemingly contradictory experience may, I think, be explained in the different myrabolams used in the Government tannery at Bombay and by the tanners in South India. That there was considerable difference between the two types of myrabolams used in Bombay and South India is, I think, shown by the difference in the price paid for them. According to the statement of cost given by Macfarlane (*) the myrabolams used in Bombay were bought at a price corresponding to Rs. 20 per candy of 500 lb. whereas South Indian tanners were at the same time paying Rs. 50 or more per candy for favourite South Indian varieties such as the 'Salems.' Generally speaking, the South Indian myrabolam gives an infusion of a much lighter colour than do the various Northern and Central Indian types (RF⁵). There is undoubtedly a considerable difference between the myrab infusion made from Central Indian types by hot and cold water whereas with Salems and other South Indian types there is no visible difference. The use of hot water also breaks down the flesh of the myrabolams quickly and thus allows a fuller extraction of the available tannin thus causing a saving in the amount required. For use with skins all coarse solid matter is removed from the liquor by pouring it through muslin cloth which removes all except very finely divided solids. The removal of the coarse material is advisable as if any broken pieces of the stone of the myrab get between the skins, they would cause small indentations which would show up in the finished skins. With hides it is usual to use the liquor without removing the pulp, the greater part of which is poured on to the top of the tub in which the hides are placed.

The skins, after working, are passed one by one through the filtered myrab liquor and are then piled into another tub on to which the remaining liquor is poured. Care is taken to avoid air bubbles being formed between the skins as these tend to give black edged round stains. After remaining in this tub for a short time, the skins are handled into another tub on to which the liquor is then poured and are left overnight after which the tannage of the skins is complete.

The working of the hides or skins during tannage is, I think, peculiar to the Madras Presidency and has a great deal to do with the excellent pattern and the spread of the skin and also to the mellow nature of the leather and to the speed with which the goods are tanned. These and the weak nature of the liquor, which seldom exceeds 10° barkometer, and is often under 5°, also accounts for

the low ratio of tannin to hide substance in Madras tanned leather and this for the small amount of bark used by the Madras tanner. Some time ago a well-known Cawnpore tanner, who visited Madras, would not believe the writer that most of the tanneries using wattle bark use under $1\frac{1}{4}$ lb. of wattle for each lb. of leather produced and it was only after he saw the work being done in several tanneries that he was satisfied that this statement was correct.

The method employed where wattle bark is used for hides is very similar to that described above. But as wattle bark is much more astringent very much smaller quantities of bark must necessarily be used. If we reckon that the average tannin contents of avaram is 17 per cent and of wattle 35 per cent it appears at first sight that 1 lb. of wattle will be equal to only 2 lb. of avaram. In practice, however, a considerable amount of tannin is not extracted from the barks and as this average is about 7 per cent with avaram and 9 per cent with wattle, it can be seen that actually only 10 per cent and 26 per cent are extracted from the two barks. From these figures it can be seen that 1 lb. of wattle can replace over $2\frac{1}{2}$ lb. of avaram. In practice, it is usual for the South Indian tanner when using wattle bark to use about 35 to 40 per cent of the amount of avaram bark he previously used.

When wattle was first used in Madras, the local tanners spoiled considerable numbers of hides by using too large quantities of this bark and by this means caused case hardening of the leather. Case hardening is the condition formed when raw hide is put into too strong a liquor, as a hard surface of tanned leather is formed on either side of the hide, which prevents further penetration of the tannin so that the centre of the hide remains more or less untanned. The South Indian tanner has now become experienced in the use of wattle and is turning out leather that is almost as good as that on which avaram is used as can be seen by the difference in price received from the users in England which is only $\frac{1}{2}$ d. per lb. less for wattle tanned than for avaram tanned. The Federation of Curriers, light leather tanners and dressers, London, have protested several times against the use of wattle bark by South Indian tanners and have stated that they very much prefer hides tanned with wattle. At the same time, however, they have never been willing to pay more than $\frac{1}{2}$ d. or at most 1 d. more for avaram tanned leather than for that tanned with wattle. As the difference in cost to the South Indian tanner has been at certain times as much as $2\frac{1}{2}$ to 3 annas per lb. and even when avaram has been exceedingly low in price has been at least one anna, it can be seen that under these conditions it has been economically impossible for the South Indian tanner to use avaram. In the opinion of the writer, the objection of the English curriers and leather dressers to the use of wattle has been caused by certain exporting firms including a certain number of case hardened hides in some of their parcels. Whilst in England in 1927, the writer visited several users of kips to find out what they objected to in wattle tanned ones and in all cases he was shown these case hardened hides. One of the largest users, when asked to show exactly what type of kip

he liked, picked out some that he described as 'Good old avaram tanned kips.' These were certainly either wattle or mixed wattle and avaram tanned as they showed a number of the tell-tale wattle barks stain.

Wattle bark unfortunately contains some substance, believed to be the gum, that under certain conditions causes unsightly brown stains on the grain side of hides and although it has been impossible directly to prove that the gum is the cause of these stains, there is such a large amount of indirect evidence available that it is generally believed to be the case. It has been found that where hides are tanned flesh side up, whenever fresh bark is given, these stains do not appear (RF)⁶. As, however, in practice it is impossible to prevent the shanks and other portions of the kip to be grain up in the pits, it is wise to hand pick the wattle bark and remove all pieces containing quantities of gum. These pieces should not be added to the pit in which the hides are placed but should be extracted in a separate tub and the liquor produced should be added to the tan pits at some part of the process and well stirred up before the hides are added. In tanneries taking these two precautions, the wattle bark stain is seldom found.

During the last five or six years, it has become general for tanners of prime skins to treat their skins with a bleaching material after they are removed from the bark and before going to myrabolams. The most regularly used material is tannic media, a product of the Havro Trading Company. On removal of the skins from the bark, they are given the usual working out and then rinsed through the tannic media and then trampled in it for from 5 to 15 minutes. It is important that this should be done in a wooden vessel and not in cement pits as the material is of very acid nature. It is also important that the amount of water used should be as small as is practicable. After the trampling, the skins are washed in one or more changes of water, squeezed and worked out over the beam again and are then sent to myrabolam bath. Skins thus treated have a greater attraction for the myrab liquor than if brought straight from the bark tubs and it is consequently advisable to use slightly less myrabolams as otherwise they get an appearance of having had too great a quantity.

The Madras process of tanning is very different from the normal process used in Western countries where it is usual to only bring the tanning materials into direct contact with the hide or skin when a very heavy tannage such as sole leather is required' (RF). For lighter leathers it is more usual to use a liquor tannage, the strength being extracted from the barks, etc., used in one set of vessels, and the hides treated in the liquor in other vessels. In many cases, skins or hides are tanned in either regular or intermittent motion in paddles or drums or by suspension. In either case, it is arranged that the tannage is started in a very weak liquor which is strengthened as the process proceeds, whereas in the Indian method, the tannage is started in the strongest liquor. The Western method has certain advantages over the Madras method, the chief one of them being that a more complete extraction of the tanning materials may be made.

Practically all European tanners and many European trained Indian tanners from other parts of India to whom I have shown South Indian tannery methods have been horrified at the amount of unextracted tannin left in the waste barks amounting as it does to about $\frac{1}{2}$ of the amount available in the case of avaram and to a quarter with wattle. Western tanners and the chemists employed in tanneries have spent a large amount of time and money in finding means of preventing this waste and have reduced it very considerably. The problem in South India is complicated by the demands of the consumers at Home. It is a well-known fact that with most tanning materials (amongst which are avaram and wattle) the more easily extracted portion of the available tannin is lighter in colour than the remainder. It therefore follows that further extraction can only be obtained at the expense of the colour of the skins. Now Madras tanned skins are particularly valued on account of their light colour and when an extremely slight dullness causes a drop of 6 *d.* per lb. in the price obtained, it can be seen that it may and in fact does, often pay a tanner to forego the extraction of extra tannin. Even with hides there is normally a difference of about one anna a lb. between prices and bests or bests and goods which chiefly depends on the colour so that here again it is doubtful if further extraction would pay.

A serious defect that sometimes appears in the early stage of tanning of the skins is that known as pitting, where the skins show minute blisters under the grain surface which show up in the finished leather as slight hollows. This defect is much commoner in the hot weather than at other times of the year. The cause of this has been found to be that the original tan liquor has not been mellow enough or has been too strong and has tended to quickly tan the surface without penetrating far into the leather, permitting the putrefactive bacteria brought forward from the elangaram to continue to act under the surface. This is in fact somewhat similar to the case hardening mentioned with wattle bark but as avaram is of a much mellow type the centre portion does tan afterwards. Pitting has been stopped in a number of tanneries by either lessening the time and the number of workings in the elangaram process or by reducing the amount of bark used in the first liquor or alternately using a greater proportion of old liquor in making up new liquor and less water. Blistering of the hides may be caused in the same way.

References.

- (1) Proceedings of the Indian Section International Society of Leather Trades Chemists, April 1929 "The Weight of Madras Tanned Kips."
- (2) Procter's Principles of Leather Manufacturer—Chapter XIX. The Chemistry of Tannins, page 338.
- (3) Indian Munition Board—Result of working the Government tannery at Dharavi, Bombay, J. W. Macfarlane, page 10.
- (4) *Ibid*, page 6.
- (5) South Indian Myrabolams—a Study-Bulletin No. 28 by K. Seshachalam Choudury.
- (6) Wattle Gum Stain (Departmental pamphlet).
- (7) Procter's Principles of Leather Manufacture—Chapter XXI. Principles of the Vegetable Tanning process.

CHAPTER XIII.

Finishing and exporting.

The South Indian tanner does not 'finish' the leather in the sense of dressing it suitably to be used for boots or for the thousand and one other uses to which leather is put, but does just sufficient finishing to make it stand packing, selection and export without suffering damage. Even in England the businesses of tanning, leather dressing and currying used to be quite separate until quite recently and is still so in many cases. This is shown by the name of one of the chief associations connected with the trade "The Federation of Curriers, Light Leather-Tanners and Dressers Inc." Even where tanning and leather dressing are carried out by the same firm leather is often dried out and stocked in the 'crust' condition which corresponds to that in which it is exported from Madras. It is normally impossible to select skins with sufficient accuracy in the raw state for different uses as the hair cover many grain defects and consequently selection has to be again made after the completion of the tannage. As in many cases the selection at the crust stage is for very many different uses it is often essential to dry out at least a portion of the goods as they are not immediately required.

On the removal from the myrabolam bath, goods are well squeezed out and worked on the flesh side as described for the bark workings and are then oiled. Particular care is taken in this working out to get the very best pattern possible. Owing to the action of the myrabolam liquor on the iron knife which forms ink it is necessary to use great care in preventing stains being formed on the flesh side which quickly happens if the knife is left in contact for any length of time. I have little doubt that the use of stainless steel knives for this process would prove of great advantage and would soon pay their cost.

In the case of skins oiling is done by sprinkling a suitable amount of oil on to the grain side of the skin and then rubbing it in with the hand placing them in pile for a few minutes, and then well re-rubbing by hand on grain and flesh. The workmen employed on this process get wonderfully skilled in giving just the right amount of oil ordered which is regulated according to the weight and class of skins dealt with. For hides, oil sprinkled on to them and then rubbed in on the grain by hand, the goods being left in pile so that the flesh of each hide is in contact with the oil on the grain of the one below. This is often done on a table or on the floor on which spent bark has been spread with the result that any oil that drains off is absorbed by the bark or runs away into the floor and is wasted. A much better plan is to use the Bombay floor which consists of a cemented square large enough to take the largest hide, slightly raised at the centre and with a channel all round so that any oil that runs off collects in this channel and can be recovered by running it into a sump from which it can be removed. Unfortunately, oil slowly reacts with cement forming dark coloured bodies

so that it is necessary to cover the floor with matting before putting hides on it as otherwise they become stained. This, however, is quite easily done as palm leaf mats that are used are extremely cheap and so the added cost of production is negligible. The amount of oil used varies considerably with different class of goods and this can easily be regulated by varying the condition of the hide or skin. If the working out of the myrabolams has been very heavily done and consequently the hide contains little moisture, there will be a greater absorption of oil than if the hide has been lightly worked and contains much more moisture. The amount of oil that can be saved by the use of this floor is very considerable and I know of one tannery where the value of the oil saved during the first month was equivalent to the pay of one of the students of the Leather Trades Institute who introduced its use. In addition to the saving effected, the oiling of hides done in this way is more even as if goods are simply laid on the floor or on a flat table, they tend to develop hollows in which oil collects and consequently soaks into the hide unevenly, whereas if the centre of the hide is raised, any excess is drained off. For hides pungam oil or a mixture of pungam and mineral oil (supplied by the Burma-Shell Company under the name of leather oil) is usually used and for skins gingelly (Til) or ground-nut oil.

Before the war control period the flesh side of hides was usually coated with grease or a mixture of grease and some filling and weighting material such as flour or Baryta. This was put on either during or immediately after the final setting out process the amount and method of application varying in different districts so that it was often easy to know in what districts hides had been tanned. The opaque coating made any selection for flesh cuts, etc., very difficult and also added considerable useless weight to the hides and was consequently prohibited during the control period and has fortunately not been restarted. Warehouses where hides are stored or selected are now much cleaner and softer than when this dope was applied as the floors then became extremely slippery and dangerous owing to becoming coated with flakes of dope which had fallen off the hides. It was also estimated that a saving of many thousands of pounds was made during the control period by this change due to the savings on freight, etc.

After the second rubbing of the oil in the case of skins, they are hung up till sammed, i.e., until half dry and in a condition that only a little moisture appears on the surface when the skin is given a double bend and squeezed strongly. The skins are now taken down and piled tightly in tubs in which they are covered and left overnight in order to obtain a greater quality of the moisture contents. In the case of hides, the goods are hung up in the drying room until they are sammed and are then taken down and left in pile in the same way that the skins were placed in the tub. The following day the skins are set out on the table by means of brass or copper slicker. In the case of skins, this setting out is done on a glass or marble

table the work being done on the flesh side, whilst the glass or marble gives the necessary polish to the grain. When the working out of the myrabolam liquor has been well done, this setting out is not a difficult business, but otherwise considerable skill is required to avoid the formation of creases in the shoulders of the skins. Recently, a peculiar stain arising in this process has been brought to my notice. When the glass tables are new and highly polished, no harm is done, if the workman permits the slicker to rub along the glass but after long use the glass becomes more or less frosted especially where this running off happens and then a minute amount of brass or copper may be left on the table. If this happens and the skin is then set over this, the brass adheres to the skin and although it does not cause any stain immediately, on keeping, a brown stain will develop. On this account, workmen should be trained to use their slickers without running off the skin on to the table and where this happens, the table should be well rubbed with a cloth before another skin is put on and before the position of the skin is changed. Hides are normally set out on wooden tables and the setting in this case is done on the grain side as it is necessary to be able to see the creases and irregularities which must then be worked out by paying attention to those portions. It is extremely important to clean the tables thoroughly each morning before use as otherwise there is a tendency for mould to develop quickly on the hides. The use of some forms of chlorine disinfectant is the most suitable for this purpose. After setting out, the goods are again hung up and dried out. This completes the process for hides which are then sent to Madras for selection and sale.

Skins undergo two further processes. First of all they are staked that is the flesh side is pulled over an upright knife in order to soften the skin and to separate the fibres. This staking should be done, more or less, in the same direction that the final working out of the myrabolams bath has been done, as if done in a different direction it is liable to pull the skin out of shape and to leave it baggy. After this, they are fluffed also on the flesh side by rubbing them with a piece of over-burnt brick or by glass paper fastened to a suitably shaped wood. To do this work a number of skins are piled over a wooden beam about the height of the shoulder of the workmen and another beam is then forced down on this pile so as to grip the skins. After the first skin has been fluffed it is thrown over the top beam and the next worked. When the whole pile has been completed, the gripping beam is removed, the pile turned round and held by the beam at the opposite end so that the opposite half may be done. In some cases, instead of the skins being held between two beams a number of them are hung on a rope which is tightly stretched just below a beam and the bundle is then passed round the beam several times until it is gripped sufficiently tight by the ropes for the work to be carried out. In a few factories where power is available fluffing machines have been installed to do this work. The working tool of these machines is a revolving cylinder covered with emery cloth of the suitable grade or in other cases the emery





PLATE NO. 10—STAKING SKINS.



PLATE NO. 11—FLUFFING SKINS.



PLATE NO. 12.—SELECTION OF SKINS IN MERCHANTS GODOWNS.

powder is fixed directly on to the cylinders by glue. The skins are pressed against this and pulled over it in such a way that all parts are dealt with sufficiently. Fluffing removes any rough pieces of connective tissues that have been missed out in the various workings and leaves the flesh with a nice 'nap.' Skins after this are ready for selection for sale or export.

The method of export and of sale differs considerably between tanned hides and skins. Tanned hides are almost always sold to exporters in Madras who select and pack them whilst skins, at any rate most of the prime and good middle class tannages are often packed by the tanners in original bales and exported to be sold at the public auctions held in London. This packing and exporting is in some cases done by the tanners themselves but more often done by one of the export houses, who check the selection and carry out the business of exporting.

Most of the larger hide tanners have warehouses, or mundies in Periamet, to which their tanned hides are sent, whereas small tanners send their goods to various commission mundies which specialize in this. Here the hides are superficially examined by representatives of export houses who then make an offer depending on the selection of the goods. If this tentative offer is accepted, goods are then sent to the godown of the exporting firm, where they are examined divided into different selection, class and assortment and a revised price then worked and offered to the tanner who either accepts or rejects as the case may be. In case of rejection the hides are then removed from the exporter's godown and are taken to the mundy or to some other godown. It is now necessary to describe as shortly as possible the selections, etc., into which the hides are divided. These usually are (1) district of origin or type, (2) selection, (3) assortment and (4) weight. In some cases other special things are taken into account such as well grown, spready, etc.

(1) *District*.—During the pre-war period, tanned hides were exported always under the name of the district in which they were tanned; such as Bangalores, Pallavarams, Amburs, Coasts, etc. During the control period, owing to the immense importation of hides from Northern India and the rules regarding clean flesh, the class of hides from different districts became much more alike and classification by districts was altogether given up and was re-placed by "spready" and "well grown" groups. Since the abolition of the control, the district classification has to some extent been re-introduced and now hides are normally classified as either Bangalores and Cocanadas which are standard groups and the ones on which prices are quoted in the trade statistics. Thus the standard prices quoted in trade papers, e.g. "The Leather World," London, are for Cocanadas 7-7½ lb. and Prime Bangalores 8-8½ lb. Certain exporters have other classes such as Madras A-1 but these are not nearly so general of the two other classes mentioned.

(2) *Selection*.—Selection is the division of the goods into primes, bests or goods according to the nature of the tannage as regards colour, mellowness, feel and general appearance, but this does not take into consideration the individual faults and damages in hides which is taken into account in assortment. The difference in value between primes and bests, and bests and goods varies considerably from time to time but has recently been somewhere about one anna in each case.

(3) *Assortment*.—Hides are assorted into seconds, thirds, fourths, fifths, rejections, etc. In the assortment such things as grain defects, brands, flesh cuts and other defects on individual hides are taken into account. Seconds means hides practically free from defects; thirds those with one or two slight defects; whilst fourths may have a brand on one side and other slight defects whilst fifth should be sound but may have brand, etc. Hides that have suffered putrefaction are classified as rejections or if very bad as cobbles. These are usually not brought into the merchants' godowns but are usually picked out either in the tannery or in the mundy and sold separately. As with selections, the price between the different grades varies from time to time but recently has been somewhere about one anna. During the control period, a much bigger difference was paid for the different assortments so as to encourage the production of the better assortments which were chiefly required. By still keeping the basic price of the goods the same, but by increasing the price of seconds, whilst decreasing the price of fourths considerably, the proportion of seconds obtained was more than doubled within a very short time. In some cases, these assortments are again subdivided into 'superior' and 'inferior.' This is more usual with poor assortments such as fourths than with the better assortments, seconds and thirds.

(4) *Weights*.—All hides are divided before being exported into definite limits of weights. Although all exporters have not the same standards and even those with standards sometimes vary these in order to suit special customers, the normal selections are as follows: Cow hides—calf skins up to 3 lb., light weights with an average of 5 to 5½ lb. containing hides of 3 to 8 lb., medium averaging 7 to 7½ for Cocanadas and 8 to 8½ for Bangalores with hides 3 to 12 and 3 to 14 lb. respectively. Heavies 15½ to 16 lb. contain hides of 14 to 18 lb. and overweights, those above 18 lb. For buffaloes—calf to 3 lb. occasionally to 4 lb. is accepted. Light weights 3 or 4 to 8. Medium averaging 11 to 12 and contains hides of 8 to 20 lb. and overweights of above this limit.

It can thus be seen that exporters may pack as many as 120 kinds of kips which explains why the individual tanner cannot export separately to the same advantage. Quoted prices are based on what is known as the regular run which normally consists of 20 per cent seconds, 60 per cent thirds, 20 per cent fourths. In some cases other proportions are mutually agreed upon between shipper and buyer such as 25, 50, 25 or even 30, 40, 30 but in almost all areas the number of seconds is the same as that of fourths. Excesses

of any class are charged plus or minus these prices as the case may be. Hides are usually packed in oblong bales of about 625 lb. in weight and measure approximately 18 to 20 c. ft. being about 3 feet 6 inches long of 2 feet to 2 feet 6 inches breadth and height. The hides are first covered with palm leaf mats and then compressed in hydraulic or screw presses and the pressure kept up by means of binding with country rope. The bales are finally wrapped in gunny. Most of the hides are exported on the c.i.f. basis but a certain amount is exported either to the auctions or for commission sale.

As mentioned previously many skins are exported to the London auctions by the tanners themselves or by exporting houses on their behalf. In these cases the skins are selected for assortment and weight and the assortment stated and the bale sold on this basis but the other separations are not done. In some cases different weights may be packed separately but this depends on the tanner and the amount of work done by him. As these are packed under the tanner's own mark the district classification is of course unnecessary whilst the same may be said for selection as the buyer examines the goods and bids accordingly.

In addition to the skins exported to the public auctions, there is a certain amount exported to England on the c.i.f. basis either by exporters or on tanner's behalf. This kind of business seems to have increased considerably in the last few years.

Skins bought by exporters in Madras are generally though not entirely of the cheaper qualities, and are dealt with somewhat similar to the hides. Here however selection is made much more according to the quality required for export to different countries than to the general appearance. Amongst the selections of the poorer qualities made in this way may be mentioned Japans, Singapores and Calcuttas which are regularly separated and are quite well known selections of sheep skins. Skins are packed in square bales of about 500 to 550 lb. by weight measuring approximately 16-18 cubic feet and being from $2\frac{1}{4}$ to $2\frac{1}{2}$ feet in length and breadth and a little longer.

As mentioned previously a considerable trade in reptile skins has developed within recent years. The most important of the reptile skins are sold by sizes, the sizes being taken by measuring the breadth of the skin. A good deal of export of this class of skins has been done by parcel post, as they are light weighing, valuable and not available in huge quantities.

CHAPTER XIV. ✓

By-products and waste Materials.

One of the chief difficulties that the tanner has to face in all parts of the world is that of the disposal of his effluent in the least costly manner. In most countries it is necessary that the effluent be treated in such a way as to bring it within the limits prescribed by the health authorities for discharge into some stream. This

varies considerably in different parts of the world and according to the size and nature of the stream into which it is discharged. The restrictions are as a rule least stringent with tidal estuaries and are most so with streams which later on in their course are used for domestic use. This is one of the chief reasons for the tendency which has developed during recent years of constructing tanneries near tidal estuaries in England and elsewhere, as in this case it is often permissible to discharge the effluent without any treatment and thus cause a great saving in cost.

In India, however, the problem is further complicated by that fact that during the greater part of the year there are no running streams in most districts with the result that it is necessary to dispose of the effluent in some other manner. Where tanneries are well away from towns or villages there is often no trouble about this, the effluent is simply run on to land and allowed to soak in, but in other districts, there is a great deal of trouble and difficulty with the health authorities. Where the effluent does not contain a too large proportion of salt, it can be used profitably for irrigation purposes and there are many tanneries where this has been done for years with the result that there has never been any smell or other offence. Where this has been regularly done, the wells in the neighbourhood show little or no change in the quality of the water and where the writer has been consulted regarding this, he has always recommended this method of disposal. Even where salted goods are treated there are many crops that will stand a certain amount of salinity and as a final case the planting of casuarina may be tried. In one case, on the recommendation of the writer, the owners of a tannery planted casuarina and irrigated it with their effluent which contained much more salt than that of a normal tannery. The casuarina grew remarkably well and it was possible for them to work it on a rotation of seven years whereas other plantations in the same neighbourhood were only cut once in 10 or 12 years. In all cases where the effluent is used for irrigation the water should be directed to different portions of the ground each day so that there is time for the ground to become dry between or after each inundation. By this means, the organic matter in the effluent which would otherwise putrefy and become offensive, is either destroyed or made inoffensive by the bacterial action of the soil or is used as plant food by the vegetation. The chief crops irrigated by the tannery effluent are the garden crops such as brinjals, maize, etc., whilst among trees cocoonut and casuarina are the commonest.

Another method that is sometimes used is to mix all the waters except the washing water which contains the greater part of the salt, which is led off in a special drain and allowed to evaporate in a special place, the saline mass being removed occasionally. In the opinion of the writer it is advisable that where the effluent is used for irrigation that it should first be passed through a masonry tank of sufficient capacity to hold one day's effluent. If this is done, a very large proportion of the impurities both soluble and insoluble are removed as they mutually react on one another forming an insoluble matter

which settles down as sludge. Some arrangement should be made by which the sludge can be removed and dried at regular intervals. This is not difficult in the dry weather if there is sufficient ground on to which it can be run so as not to be of too great depth. The sludge contains considerable quantity of lime, hair and various other organic matters and forms quite a useful manure for which there is regular demand from ryots. In places where the effluent runs on to a piece of low lying land and soaks into the earth, the wells in the neighbourhood are usually affected as can be seen from the examples given in the Departmental Bulletin No. 37. Stain on Madras tanned Hides and Skins and No. 3 Note on South Indian Tannery waters. It has been somewhat difficult to absolutely prove that the seasonal changes in the tannery wells are chiefly due to the effluent, but the case of a tannery in which leather for export had been tanned for many years and which has become a chrome tannery goes a long way to prove this. When the tannery was doing bark tannage, the water of the well, although it contained both permanent and temporary hardness contained very little of soluble sulphates. When chrome tanning had been done for sometime, the amount of soluble sulphates in the water increased very considerably and as this is the chief impurity in waste chrome liquors, the evidence is very strong that some of this had returned to the well.

All chrome salts are very poisonous to the vegetable kingdom and hence effluent from chrome tanneries need more care in their use for irrigation than does that from ordinary tanneries. With chrome liquors it is very necessary that sufficient alkali be mixed with chrome liquors to completely precipitate all the chromium. This should as far as possible be done and separated from the other liquors and the sludge thus obtained can be separated and not mixed with the other as it spoils its value as a manure. Where a considerable quantity of weak chromium liquor has to be got rid of, it may be treated after preliminary settling or filtering with sufficient soda ash to precipitate the chrome hydrate which is then either allowed to settle or filtered off and redissolved in acid to form a new stock liquor. This procedure has been in use in one tannery for some time and has proved that the cost of the treatment is considerably less than the value of the liquor produced.

Sludge.—As mentioned above, the sludge from effluent from other than chrome tanneries is a valuable manure and is usually disposed of to the local ryots who are willing to pay a small amount for it.

Used Lime.—The balance of the lime removed from the lime pits is quite useful in many districts as a dressing for fields. There is unusually little difficulty in getting it removed and in many cases as with the sludge above mentioned, the ryots are willing to pay a small amount for the right of removing it. In certain districts, the lime slab is a perquisite of the workmen who dispose of it for putting on the fields or for building purposes.

Wool and Hair.—Most of the wool produced in South India is of poor quality and is only used for cheap quality blankets and

carpets. Where it is obtained by painting the flesh of the skins with lime, it is little damaged and almost equivalent to the clipped wool from the same type of sheep. Where it is obtained from limed skins, it contains a large quantity of lime and has lost the greater part of its strength and felting properties but is nevertheless used considerably in the manufacture of cheap blankets and carpets. Hair produced in hide tanneries is of a very short nature and has no commercial value other than as manure. Hair from sheep although slightly longer is also almost used as manure. Hair contains a considerable amount of nitrogen and is therefore quite useful as manure. The nitrogen, however, is only given off slowly and hence its benefit is not as noticeable as is the case with soluble nitrogen manures such as ammonium sulphate or nitrates, but on the other hand the effect on the land remains longer. Hair from goat skins has a commercial value for mixing with wool in the cheaper quality blankets and carpets and there is quite a large demand for this and for similar purposes. As pointed out under unhairing it should be separated into different colours as by this means better prices are obtained.

Fleshings.—Hide fleshings should be washed and dried and are then valuable as glue stock or manure. Unfortunately they are extremely bulky and exceedingly difficult to compress and bale with the result that the charge for freight often makes it uneconomical to export. During the greater part of the year, the manufacture of glue from fleshings on the plains of South India is impossible without costly plant and experiments made by the Department of Industries tend to show that even with up-to-date plant it is an uneconomical proposition in this climate and with the small demand for glue that there is in South India. The report on the glue experiments is found in a Departmental Bulletin entitled "The Manufacture of Glue in the Tropics from tannery refuse." It is rather astonishing to find that the yield of glue from South Indian fleshings was as low as 12 to 20 per cent whereas in other countries glue factories expected to get a yield of about 30 per cent.

Spent Bark.—The great bulk of the spent bark in South India is used in brick kilns as a source of fuel and it is very suitable for this work. In the immediate neighbourhood of Madras, a good deal is used on the race course and on the riding track on the Marina. Firms who use steam power use their spent bark after drying as fuel and certain firms have tried to use it in suction gas plant but for this it has not been very successful on account of the difficulty found with the large amount of tar produced. In some case, this like lime is a perquisite of the workmen who dry it and dispose of it as fuel.

Bark dust.—The dust sieved out from the bark is usually sold to the village tanners who use it in tanning pieces or bad rejection hides.

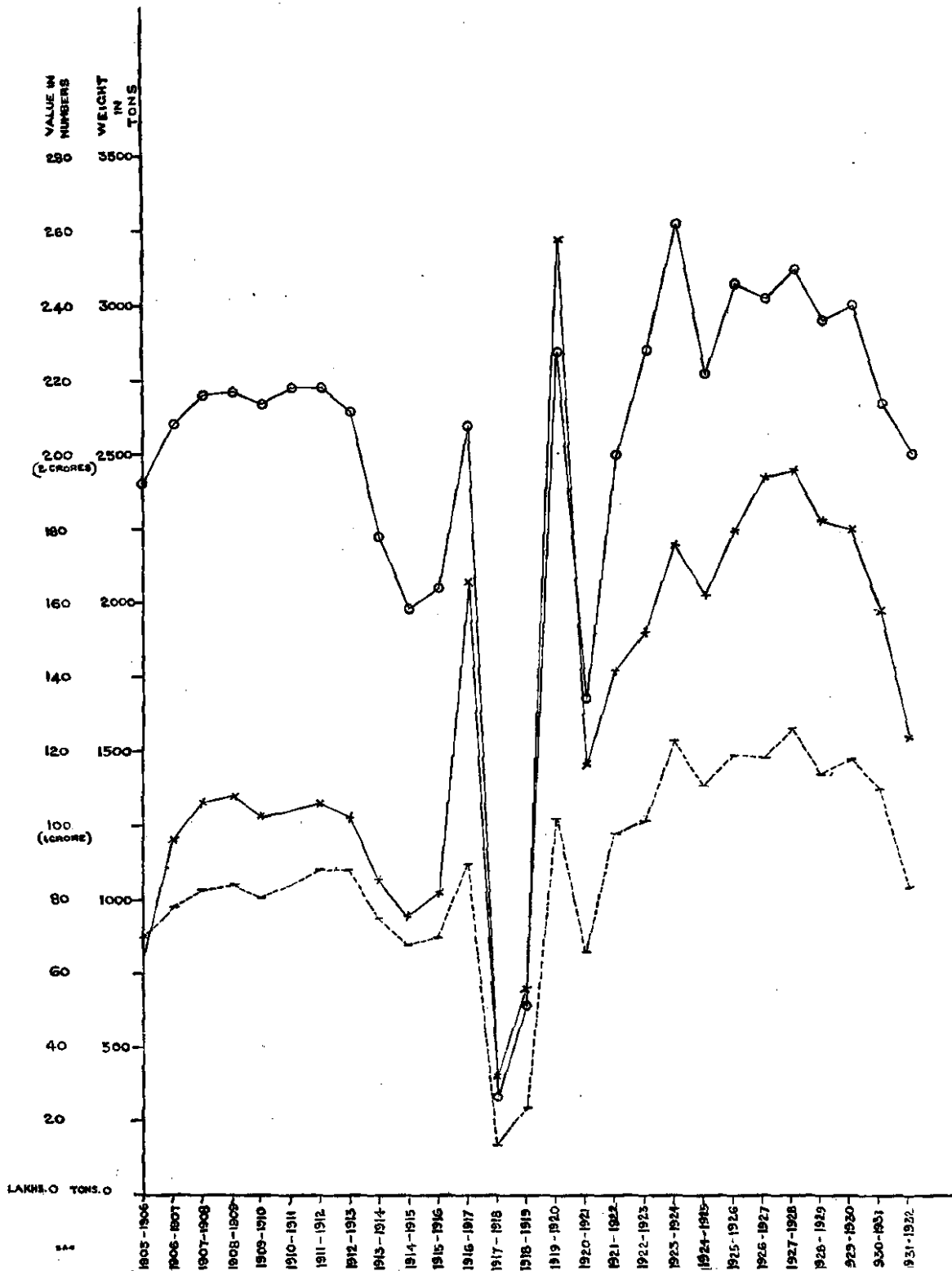
References.

- (f) G. O. No. 330, Development, dated 5th March 1925.

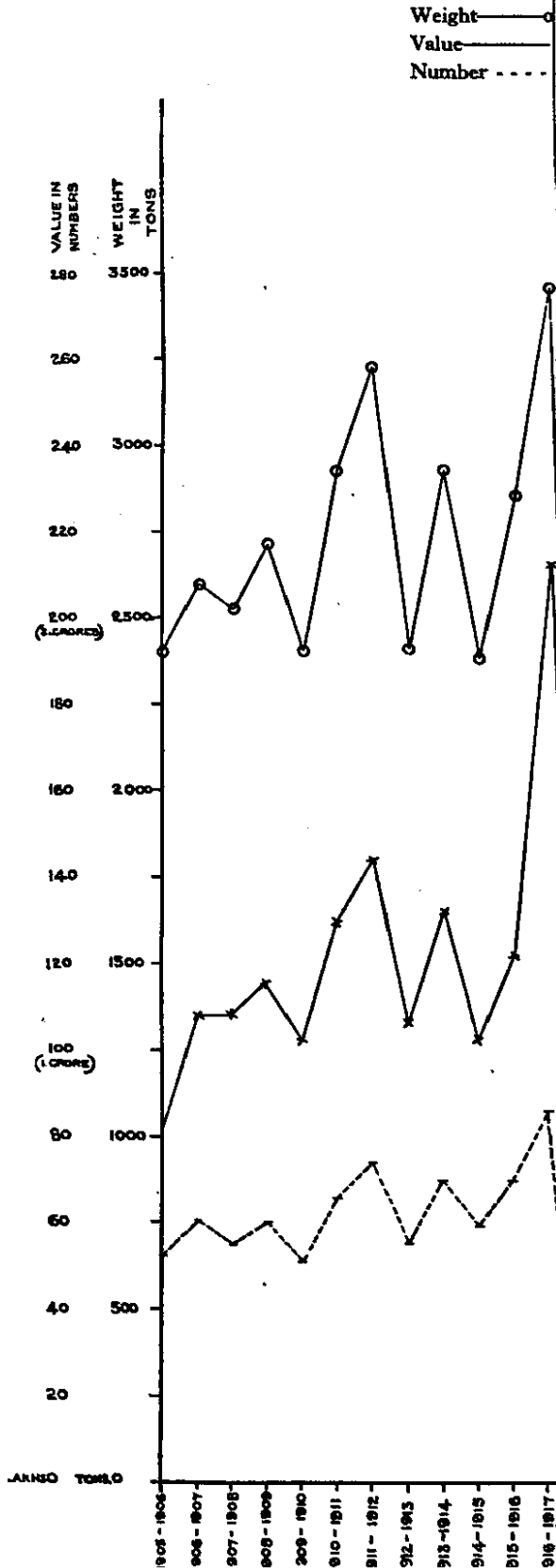
APPENDIX

No. 4.—Exports from Madras Presidency—Tanned Sheep Skins.

Weight —○— 250 Tons.
 Value —×— 1 Unit—20,00,000 Rs.
 Number - - - - - 1 Unit—2,000,000 Skins.

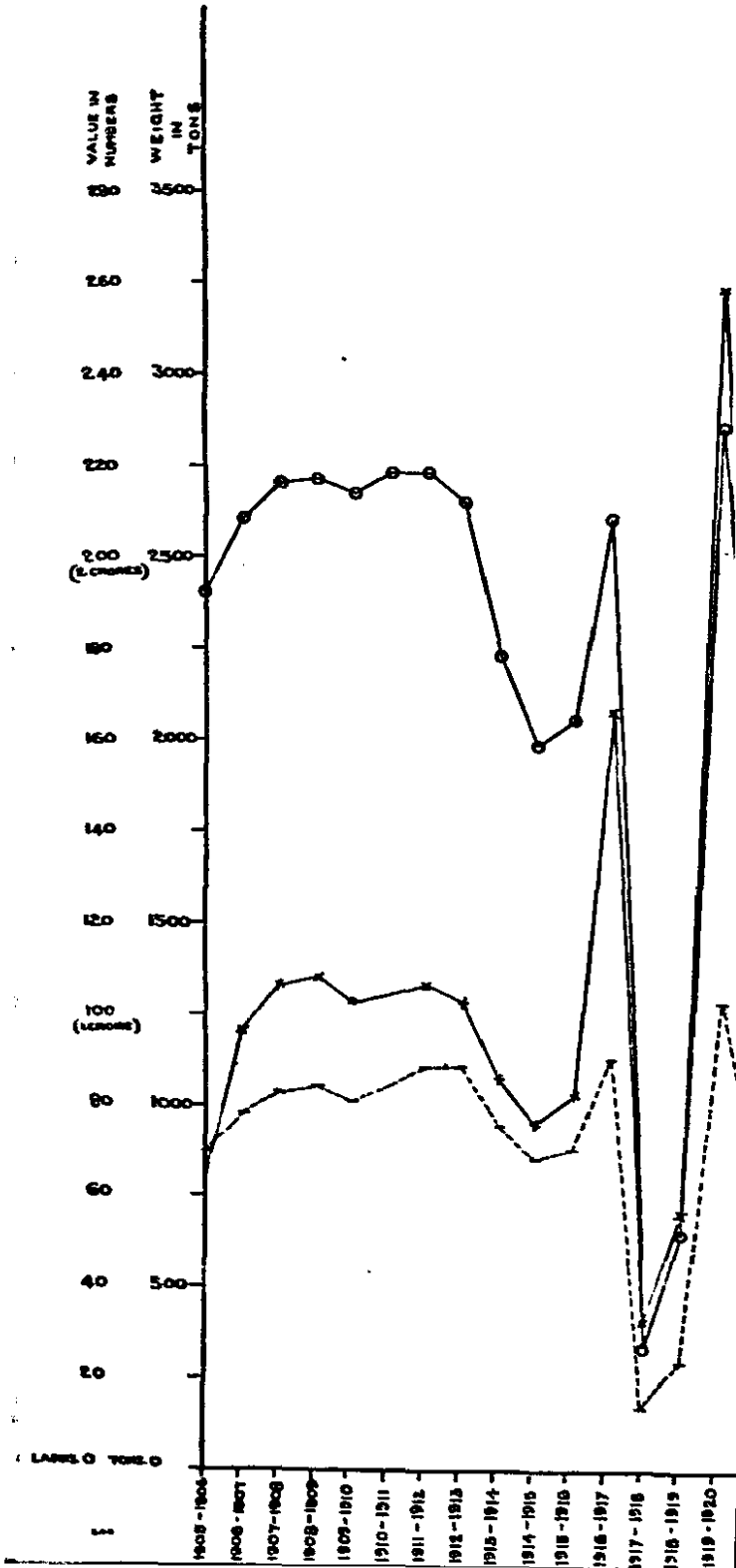


No. 3.—Exports from Madras

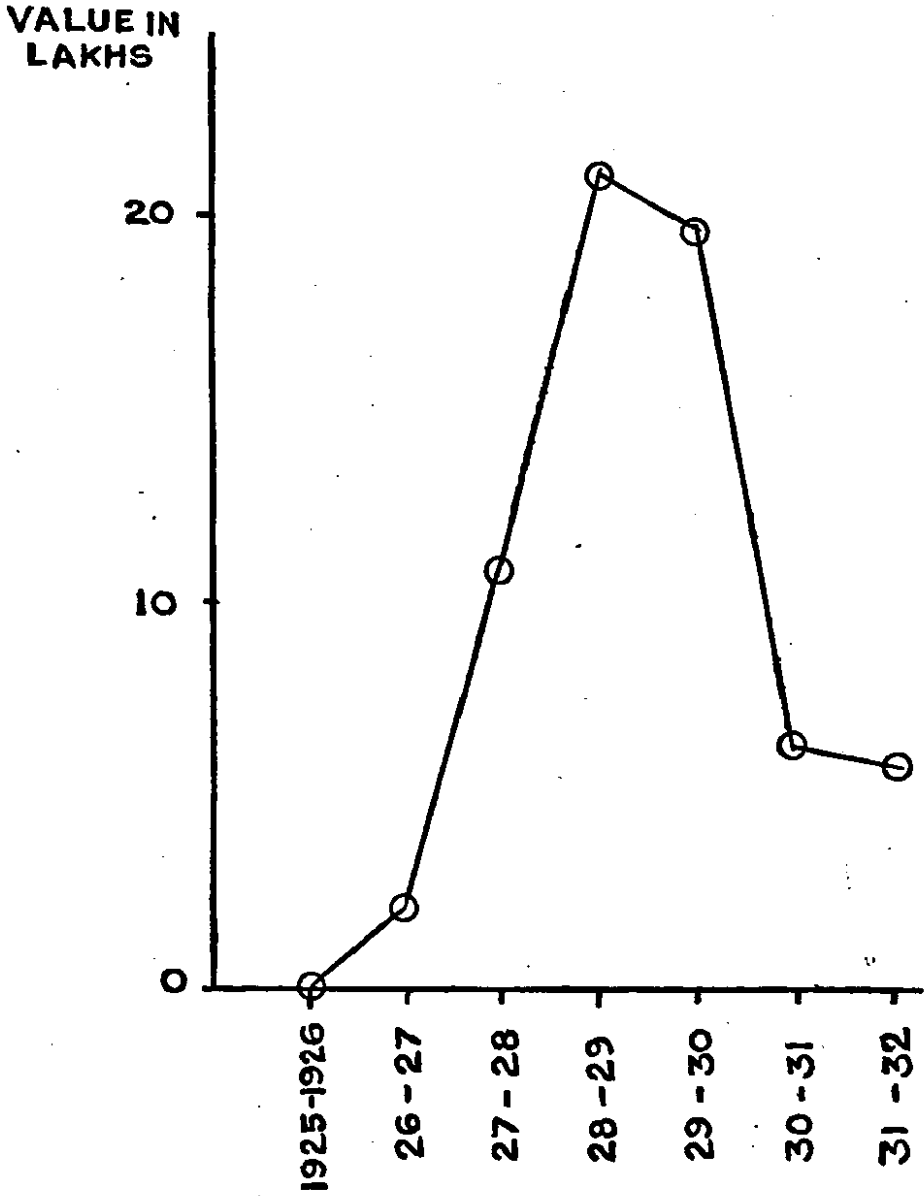


No. 4.—Exports from Madras Presidency—

Weight ———○——— 1 Unit
 Value ———x——— 1 Unit
 Number - - - - - 1 Unit

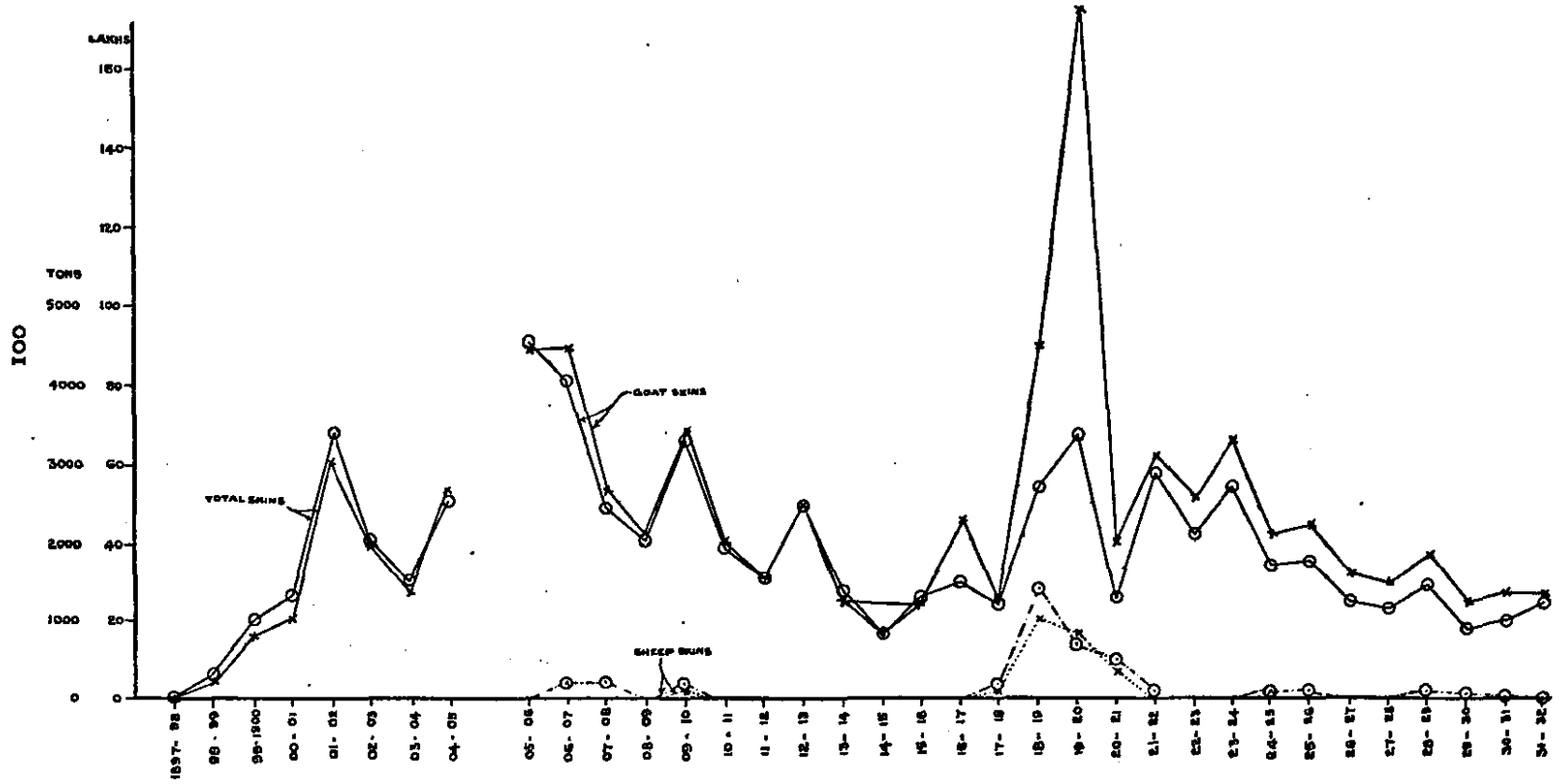


No. 5.—Graph showing Value of Tanned Reptile Skins exported from Madras.



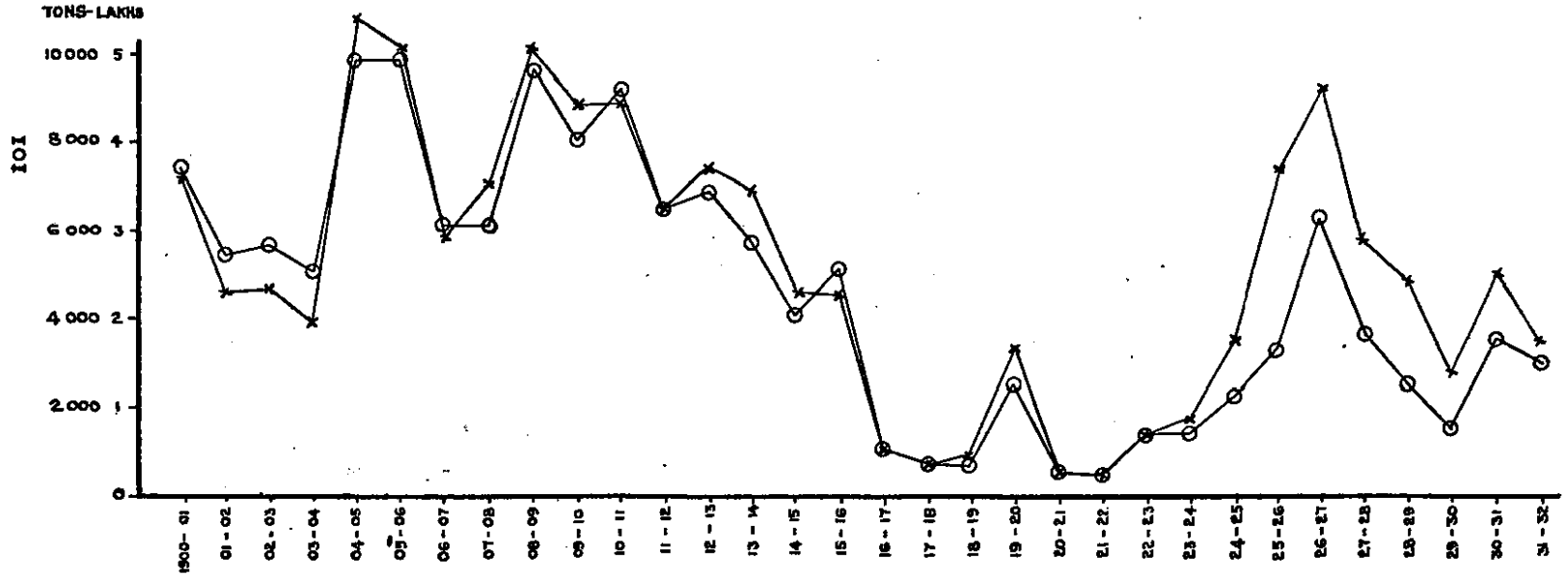
No. 6.—Export of Raw Skins from Madras.

—○—○— Weight 1 Unit = 1,000 Tons.
 —x—x— Value 1 Unit = 20 Lakhs.

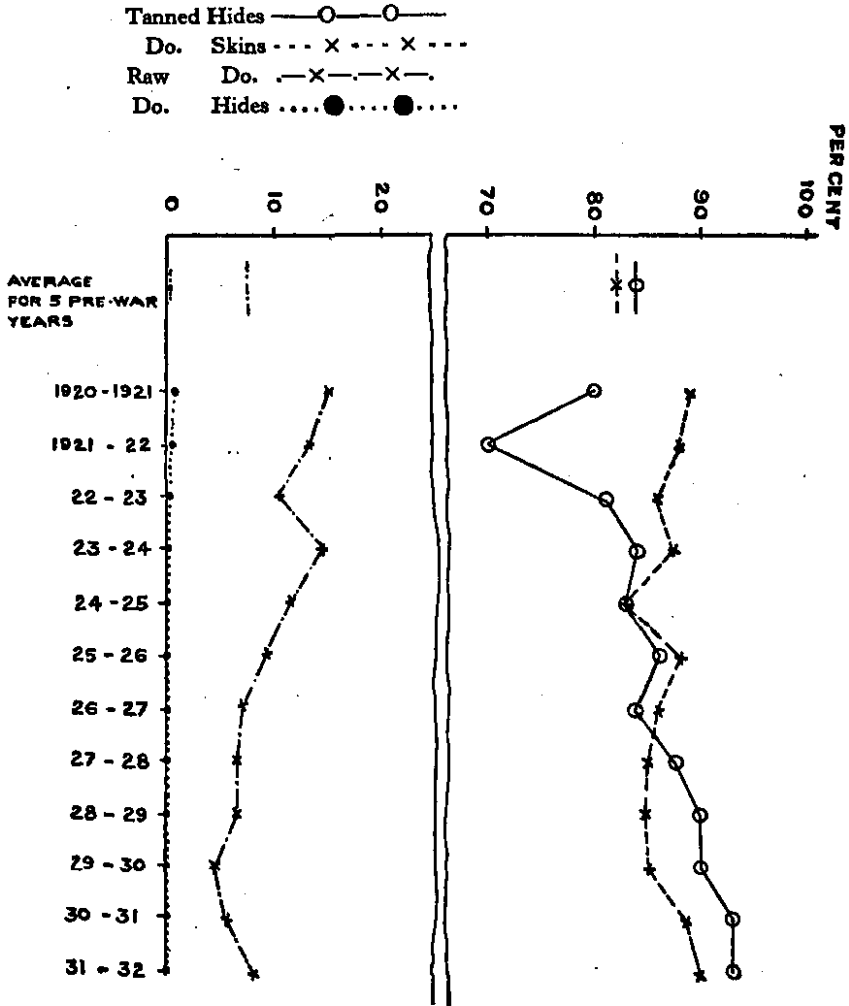


No. 7.—Export of Myrabolams from Madras.

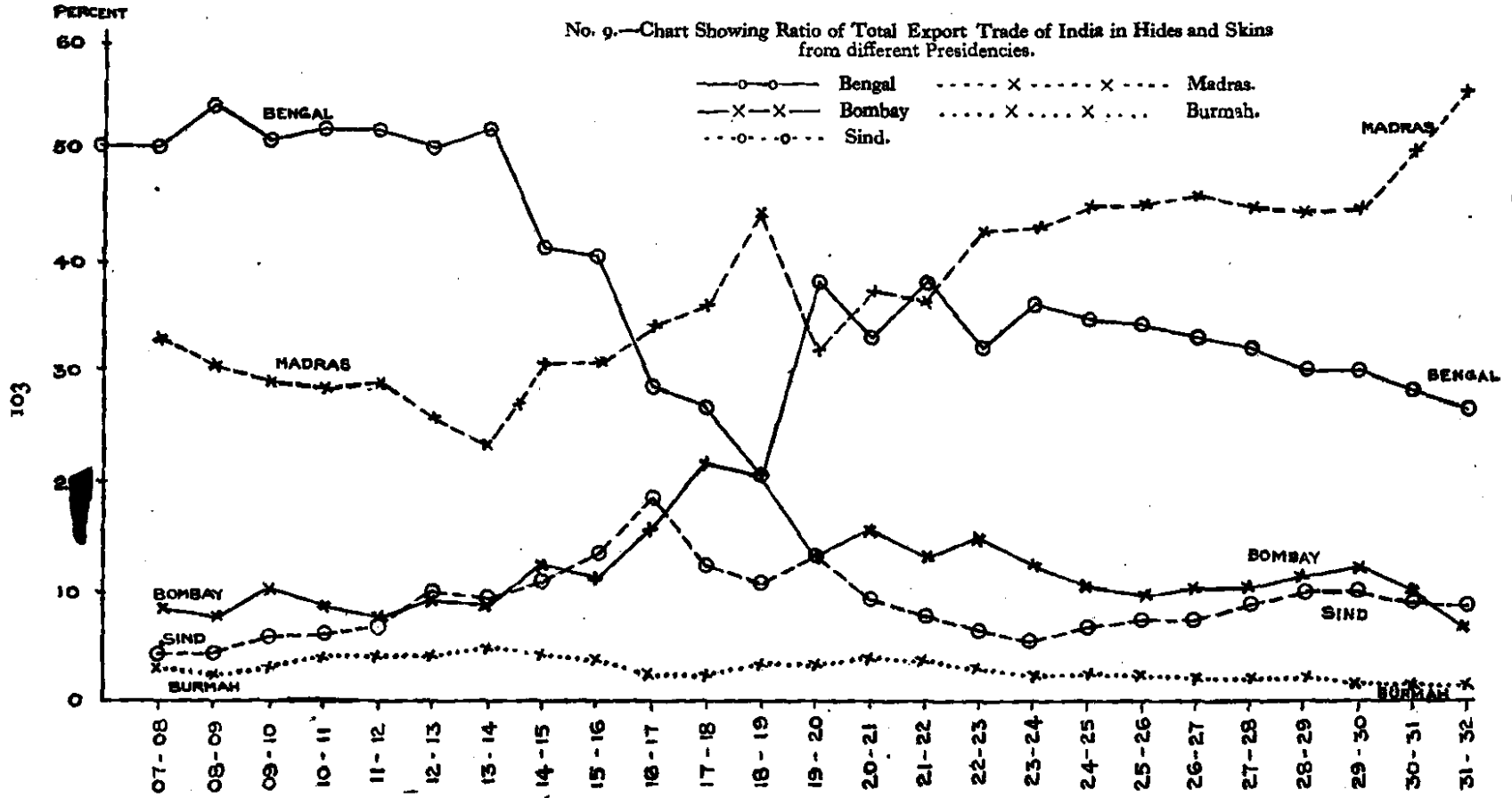
—○—○— Weight 1 Unit = 2,000 Tons.
 —×—×— Value 1 Unit = 1 Lakh.



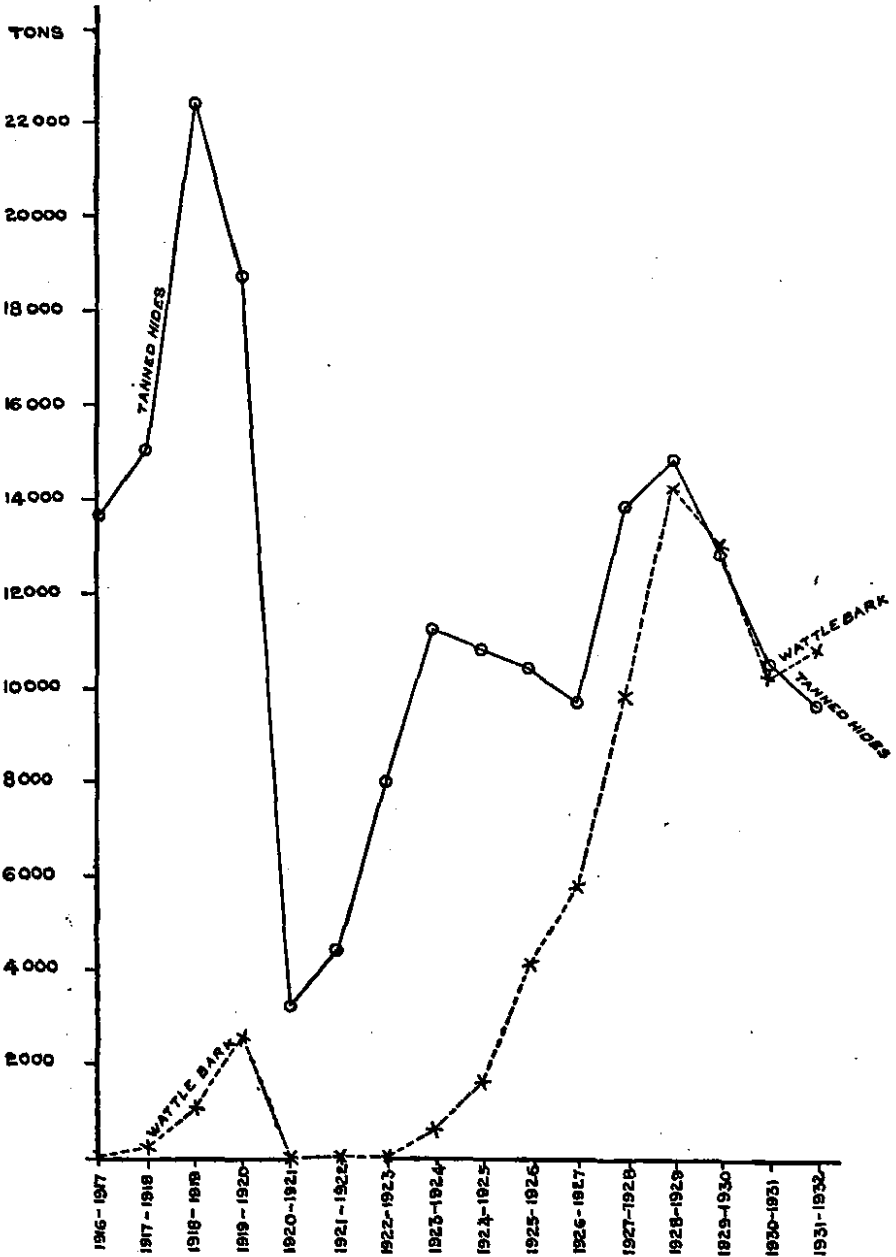
No. 8.—Graph showing Madras Share of the Export Trade of India in



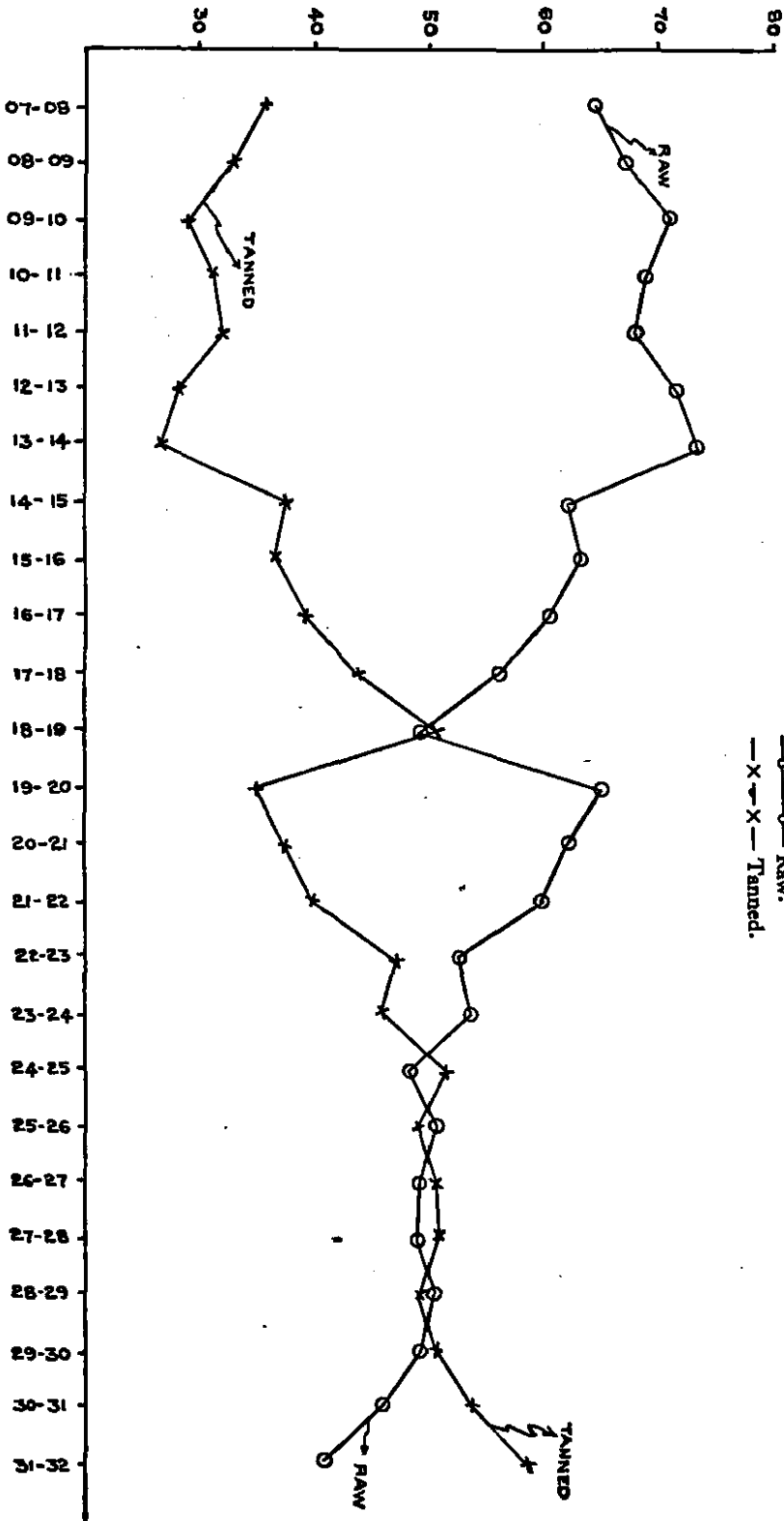
No. 9.—Chart Showing Ratio of Total Export Trade of India in Hides and Skins from different Presidencies.



No. 10.—Export of Tanned Hides —○—
Imports of Wattle Bark - - - X - - -
1 Unit = 2,000 Tons.



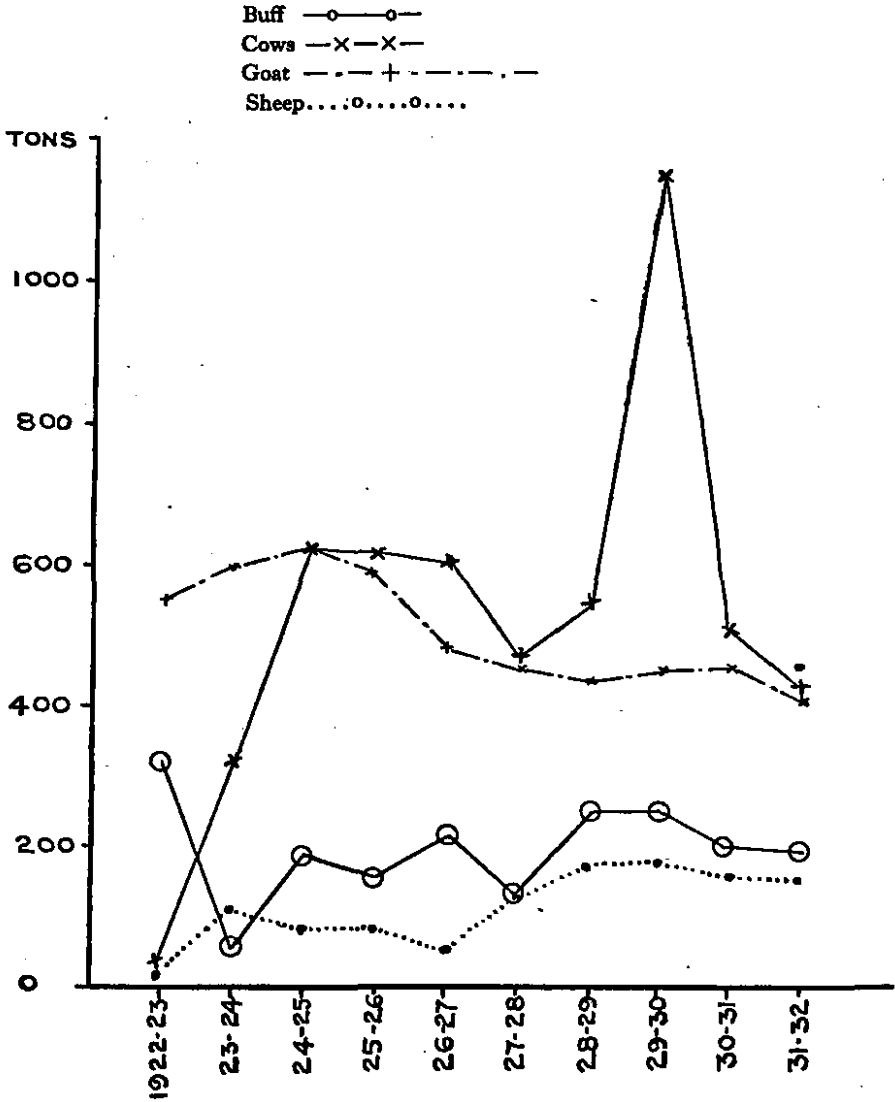
PERCENT.



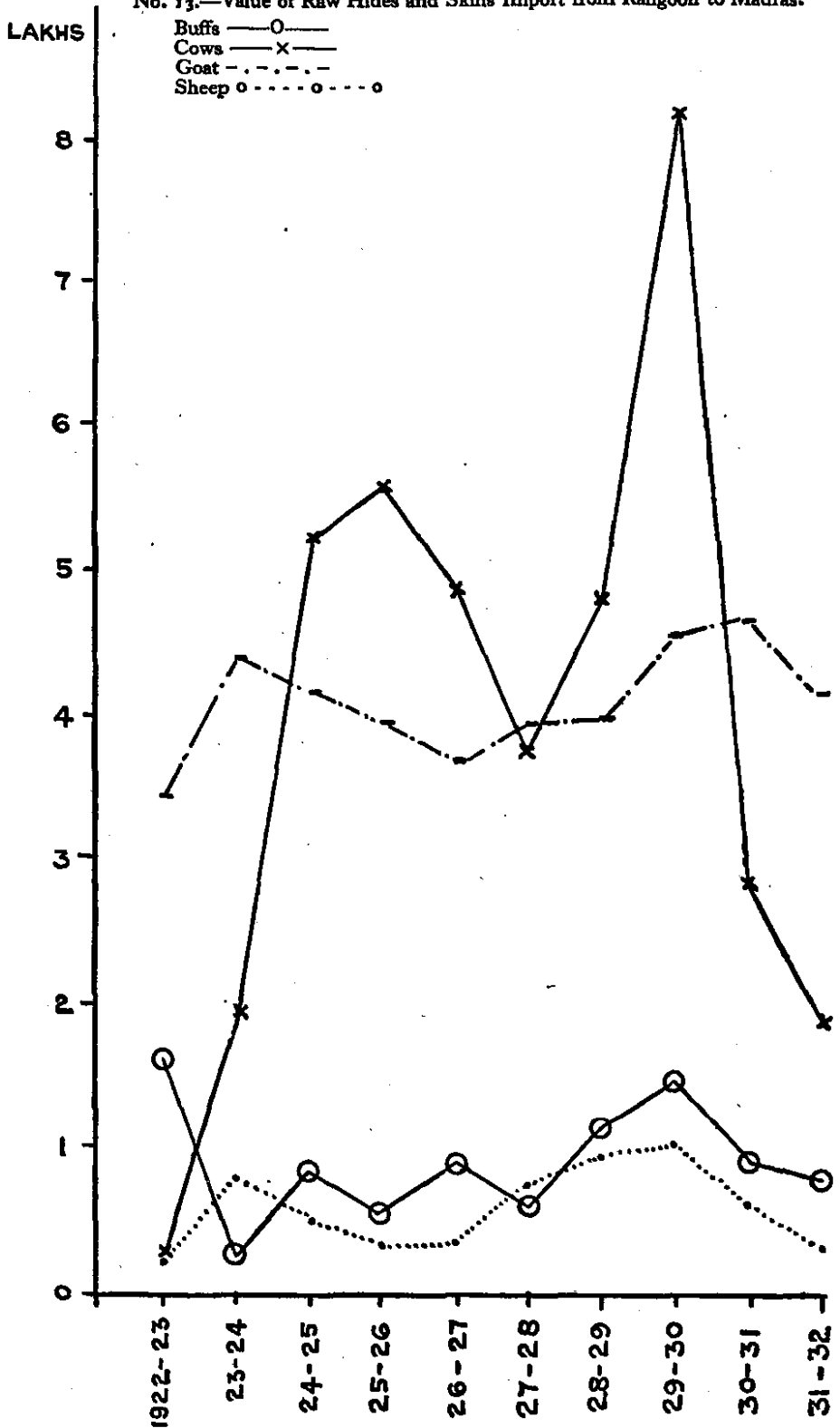
No. 11.—Chart showing Ratio of Value of Raw and Tanned Hides and Skins Exported from British India.

—○— Raw.
—X— Tanned.

No. 12.—Imports of Raw Hides and Skins from Rangoon to Madras in Tons.



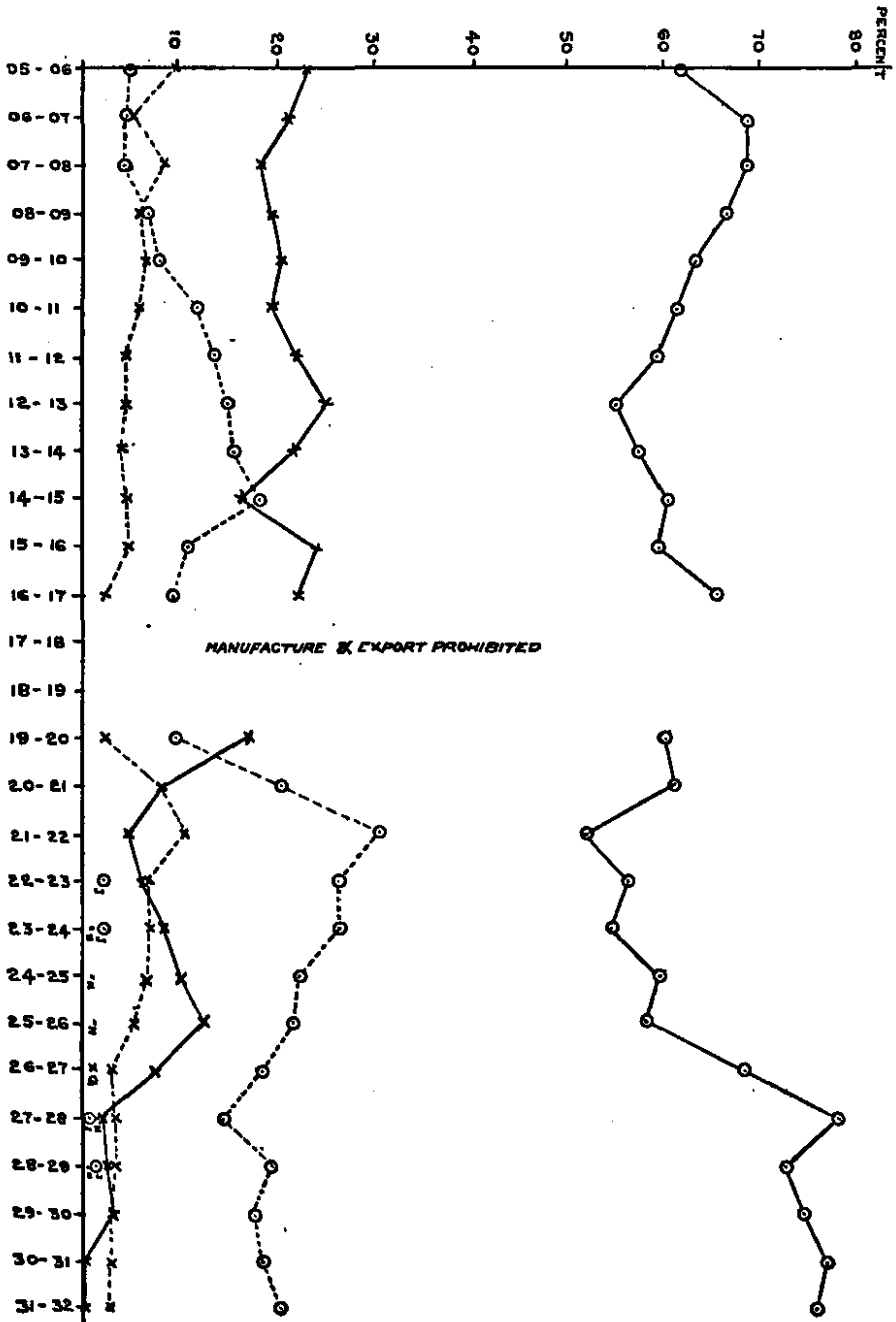
No. 13.—Value of Raw Hides and Skins Import from Rangoon to Madras.



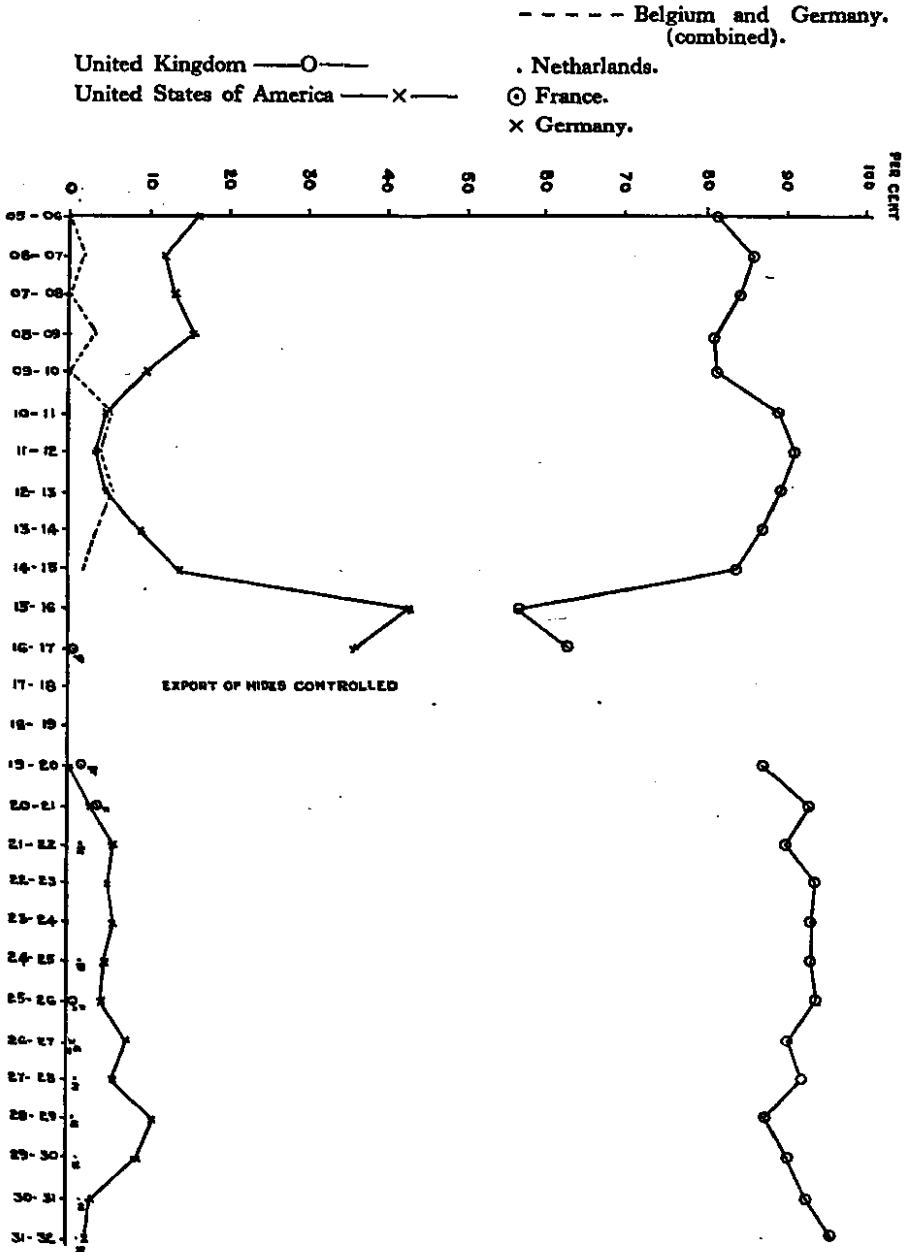
No. 14.—Ratio of Export of Tanned Sheep Skins to different Countries.

United Kingdom ———○———
 United State of America ———×———
 Straits - - × - -
 Japan - - - ○ - - -

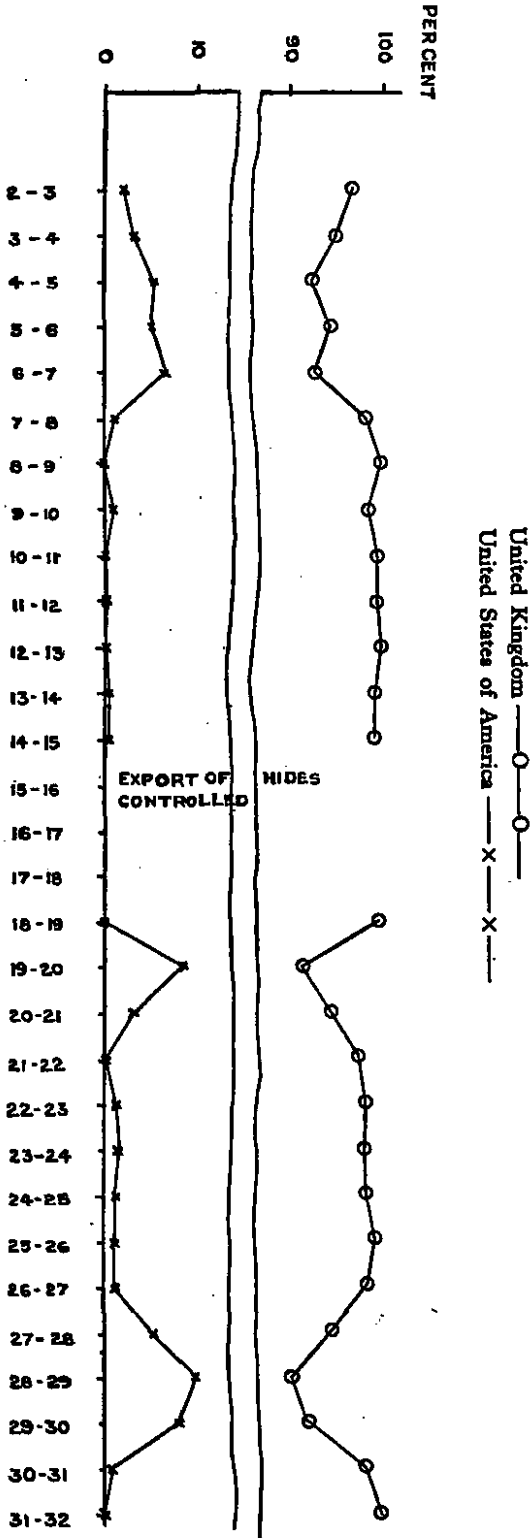
⊙ J. = Java.
 . N. = Netherlands.
 × G. = Germany.



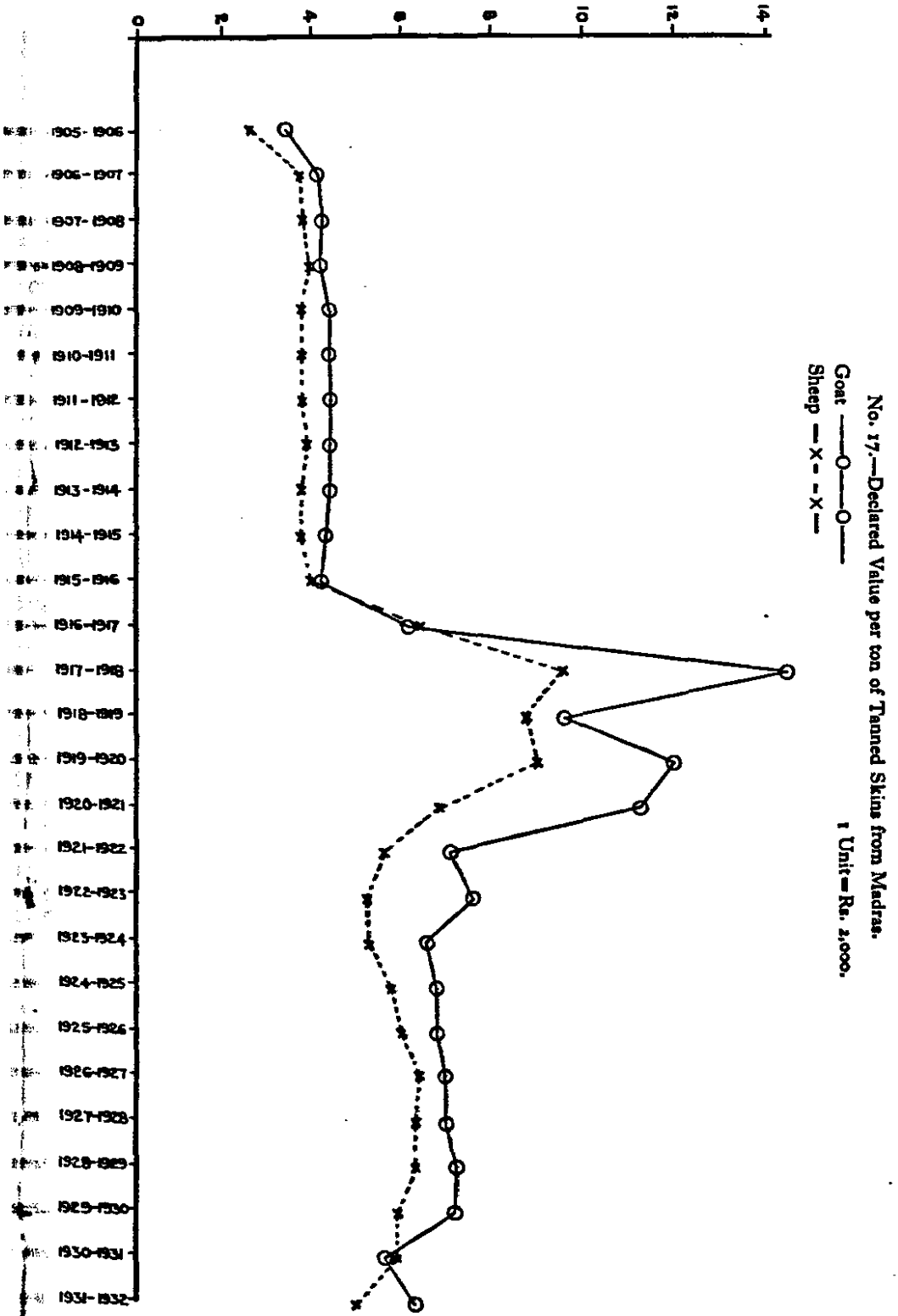
No. 15.—Ratio of Exports of Tanned Goat Skins Exported to different Countries.

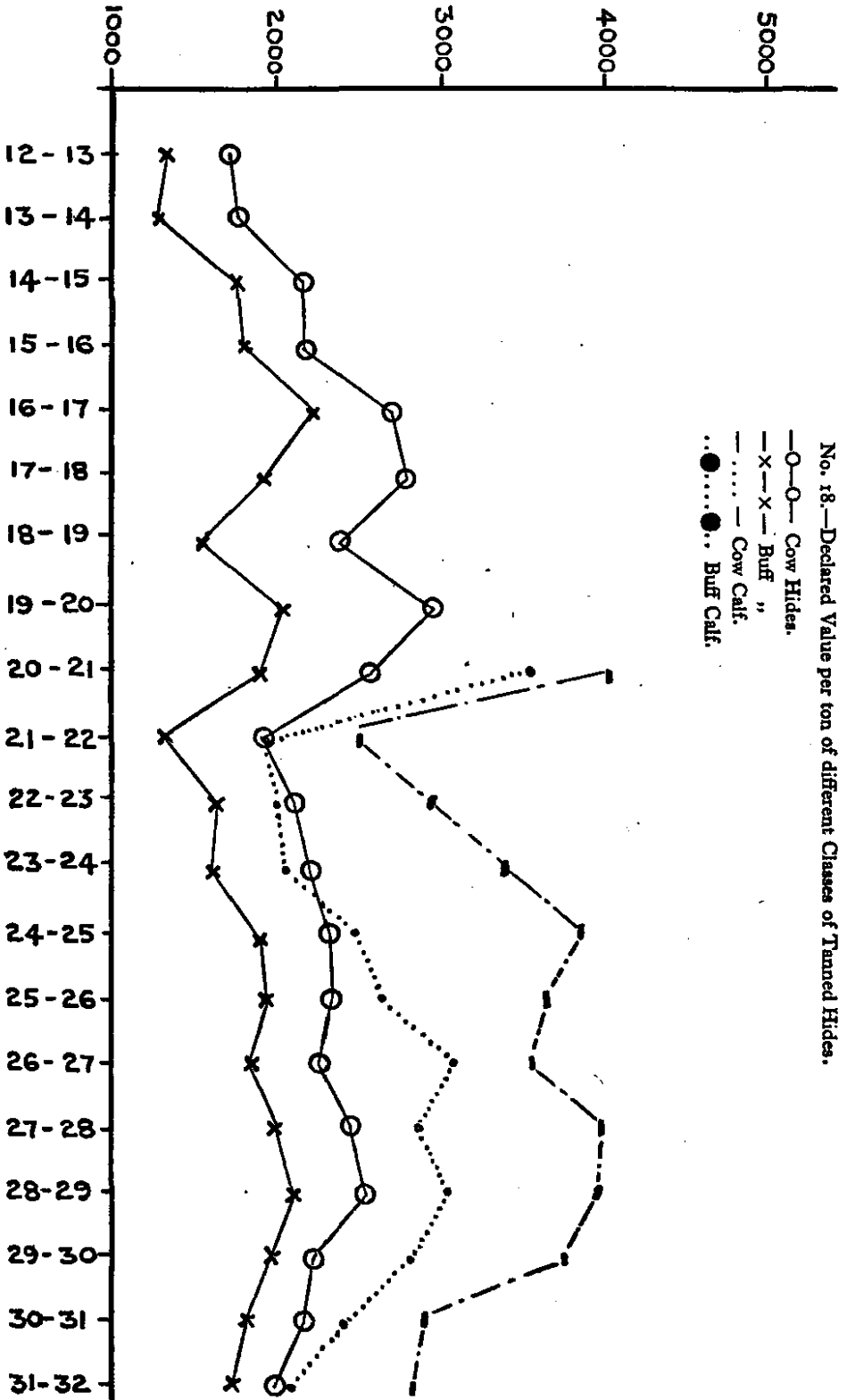


No. 16.—Ratio of Exports of Tanned Hides Exported to different Countries.



VALUE IN THOUSANDS OF RUPEES





No. 18.—Declared Value per ton of different Classes of Tanned Hides.

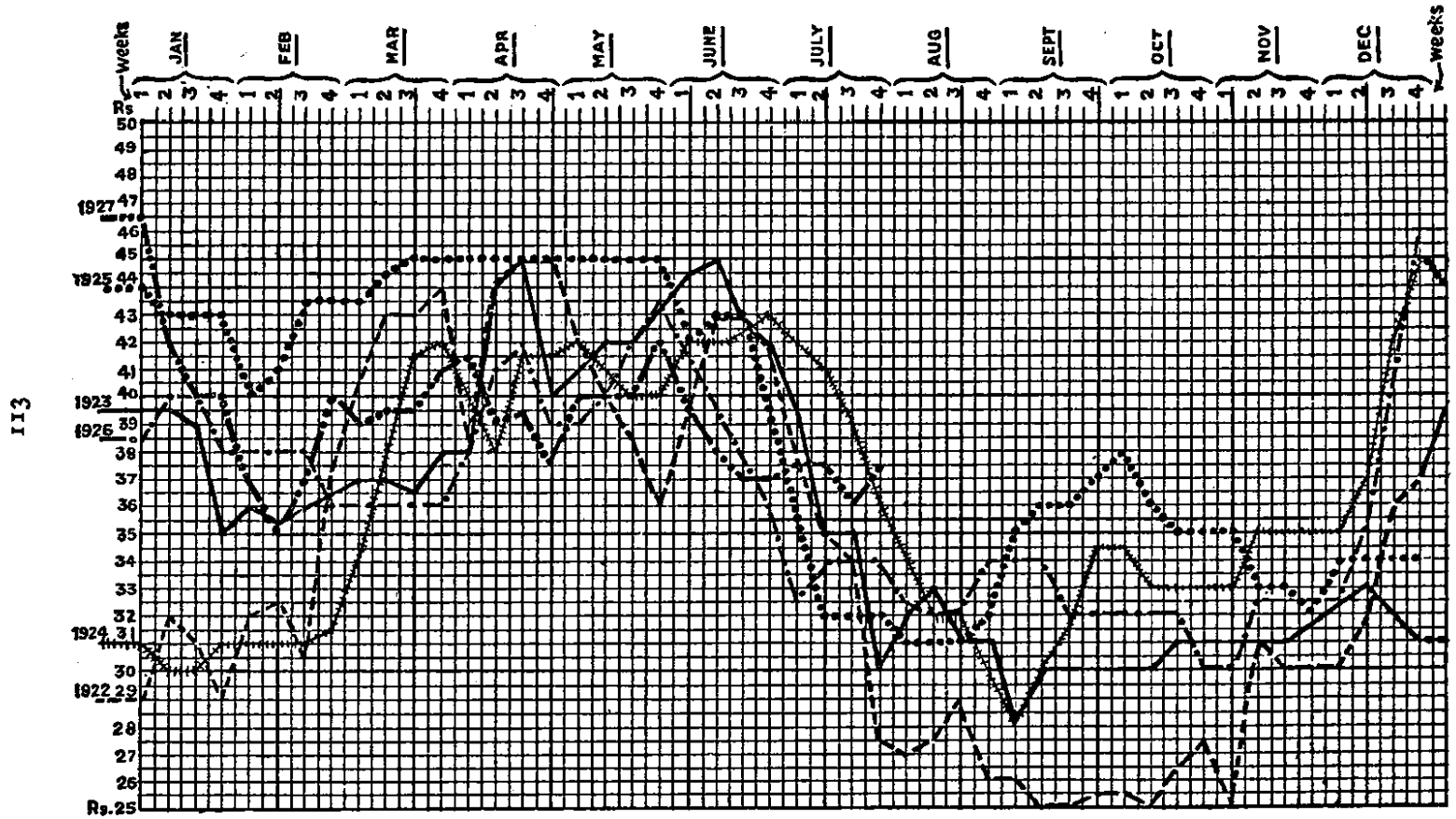


PLATE NO. 4—AVARAM BARK MARKET, MADRAS, PRICE PER CANDY.

BULLETIN OF THE U. S. BUREAU OF LABOR STATISTICS.

NO. 260.

WASHINGTON.

NOVEMBER, 1919.

WAGES AND HOURS OF LABOR IN THE BOOT AND SHOE INDUSTRY: 1907 TO 1918.

INTRODUCTION AND SUMMARY.

Rates of wages (or earnings) per hour, hours of labor per week, and full-time and actual weekly earnings in the year 1918 in the boot and shoe industry of the United States are presented in this report. Comparable figures for 1916, and summaries for each year from 1907 to 1918, except 1915 and 1917, are also shown. Data were not collected for 1915 and 1917.¹

In 1918 the average full-time weekly earnings of male employees in the selected occupations shown varied from \$19.36 for treers or ironers, machine, to \$32.29 for Goodyear welters.

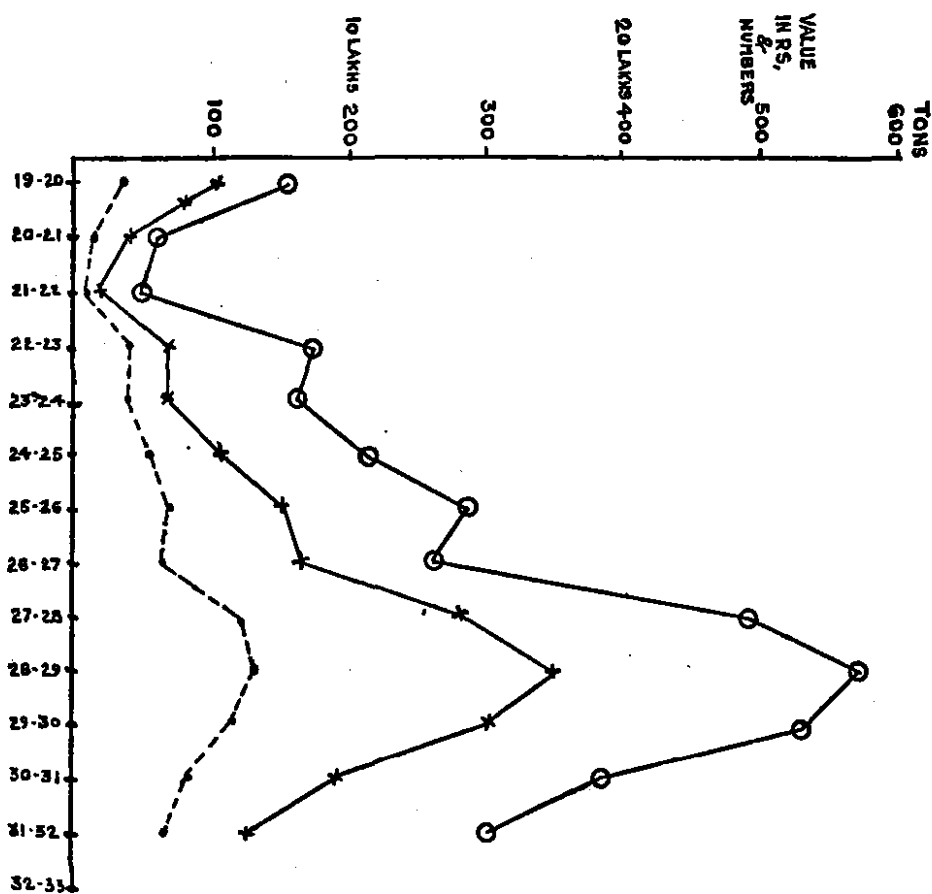
The full-time weekly earnings of female employees varied from \$12.06 for button fasteners to \$16.11 for vampers.

A summary of the rates of wages (or earnings) and hours of labor, in 1913, 1914, 1916, and 1918, in the principal occupations of the industry, and of other employees, is presented in Table 1 which follows:

¹ Previous investigations of wages and hours of labor in boot and shoe manufacturing have been made and published by the Bureau, as follows: Nineteenth Annual Report, covering 1890 to 1903; Bulletin No. 59 (July, 1905), covering 1903 and 1904; Bulletin No. 65 (July, 1906), covering 1904 and 1905; Bulletin No. 71 (July, 1907), covering 1905 and 1906; Bulletin No. 77 (July, 1908), covering 1906 and 1907; Bulletin No. 134 (August, 1913), covering 1907 to 1912; Bulletin No. 154 (May, 1914), covering 1912 and 1913; Bulletin No. 178 (August, 1915), covering 1913 and 1914; and Bulletin No. 232 (May, 1918), covering 1914 and 1916.

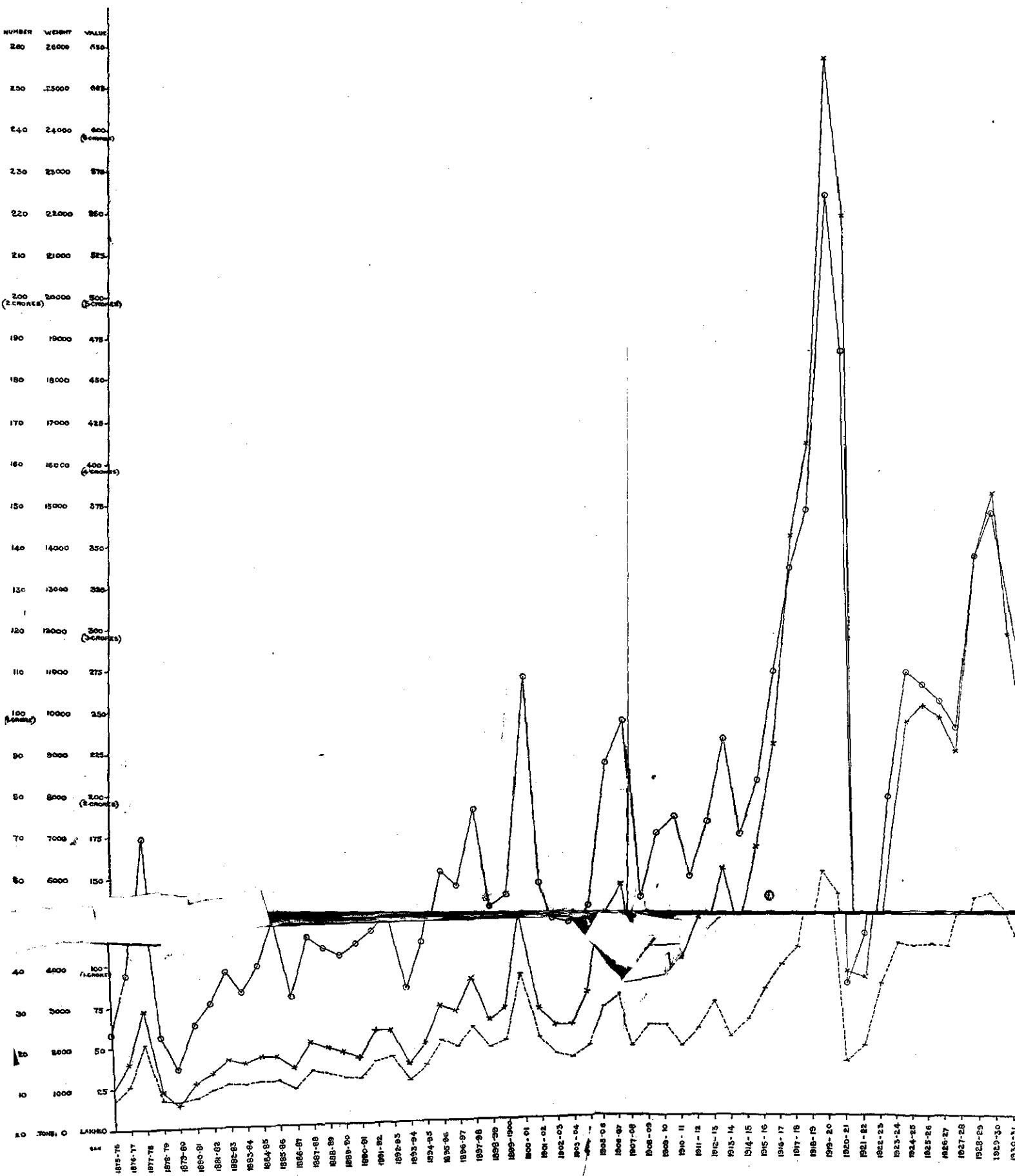
No. 22.—Export of Buff Calf Skins

- 1 Unit = 100 Tons —○—○—
- 1 Unit = Rs. 5 Lakhs —X—X—
- 1 Unit = Rs. 5,00,000 —o—o—o—o—o—o—

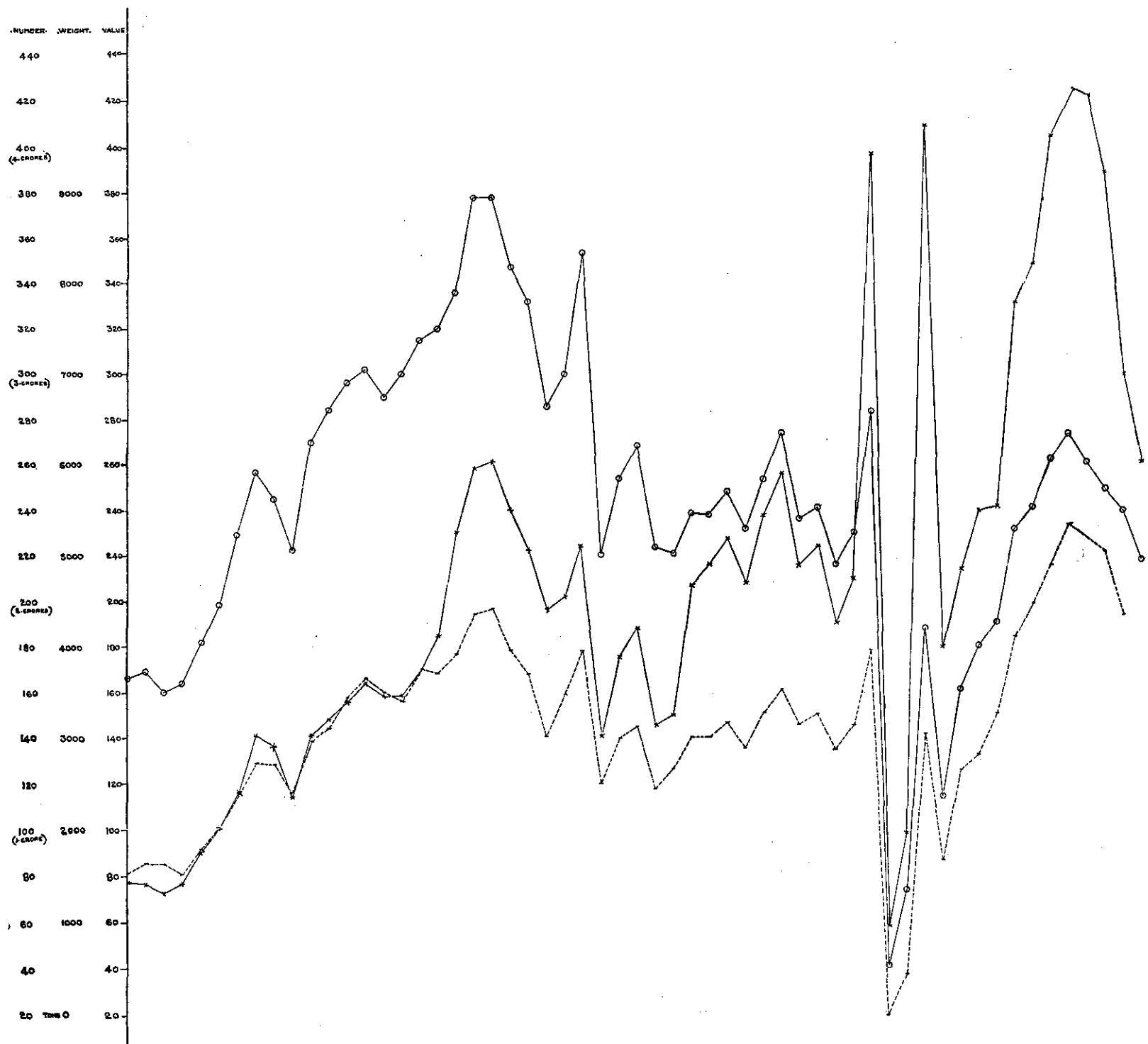


No. 1.—Exports from Madras Presidency—Tanned Hides.

Weight —○— 1 Unit = 1,000 Tons.
 Value —x— 1 Unit = 25,00,000 Rs.
 Number 1 Unit = 1,000,000 Hides.



Weight —○— 1 Unit = 500 Tons.
 Value —×— 1 Unit = 20,00,000 Rs.
 Number 1 Unit = 2,000,000 Skins.



No. 3.—Exports from Madras Presidency—Tanned Goat Skins.

Weight—○—1 Unit—250 Tons.
 Value—×—1 Unit—20,00,000 Rs.
 Number—●—1 Unit—2,000,000 Skins.

