

KAURI-GUM INDUSTRY.

Presented to both Houses of the General Assembly pursuant to Section 5 of the Kauri-gum Industry Amendment Act, 1914.

Under-Secretary of Lands.

1916.	£	s.	d.	1916.	£	s.	d.
March 31. To Balance	32,000	0	0	March 31. By Debentures issued under the Kauri-gum Industry Amendment Act, 1914 ..	32,000	0	0
	<u>£32,000</u>	<u>0</u>	<u>0</u>		<u>£32,000</u>	<u>0</u>	<u>0</u>

1—C. 12.

REPORT OF THE KAURI-GUM SUPERINTENDENT.

SIR,—

The special circumstances which gave rise to the intervention of the Government in the kauri-gum business were fully recounted in the report presented to Parliament last session, but it may be pertinent to gain briefly refer to them.

Shortly after the declaration of war there was a decided slump in the industry. Buying practically ceased by the Auckland traders, and pressure was brought to bear on the Government by petitioners and by members of Parliament to take some action to prevent the distress which was considered likely to arise among the workers in the industry. A report was obtained on the actual state of affairs, and as an outcome of it a short enabling Act was passed, known as the Kauri-gum Industry Amendment Act of 1914. This Act empowered the Minister of Lands to make advances up to 50 per cent. on the estimated value of the gum on the basis of prices ruling in July of that year. The Act came into force on the 6th November, and the first advances were made shortly afterwards.

In addition to authority to make advances on account of purchases of gum the Minister was empowered to employ men to work on the Crown gum lands. This was given effect to, and the system known as "face digging" was put into operation, the special feature of which is that while recovering the gum from the ground the surface is left in an even condition and suitable for subsequent farming operations.

The amount advanced on account of purchases of gum up to the 31st March of this year was £5,747. For several months past there has been little or no demand for the Government advances owing to the fact that the local merchants have been buying gum freely at fairly good prices.

The Act above referred to provided, *inter alia*, that when the gum was sold the proceeds were to be paid to the original vendor less the amount advanced and all charges incurred in connection with the handling of the gum, including interest, insurance, freight, administration charges, &c.

Up to the present time no sales have taken place, but arrangements have been made with a view to placing the gum on the American market at an early date. To that end Messrs. G. W. S. Patterson and Co., of New York and Auckland, have been appointed agents for the Government in America. A proper contract has been entered into with the firm, under which they undertake to guarantee the financial stability of purchasers. The agents are to be paid a commission on sales effected. Samples of the various grades of gum were sent to the agents some months ago, and subsequently a shipment was sent forward, which is expected to reach New York some time this month.

Since the declaration of war by far the greatest quantity of the gum exported from New Zealand has been sent to the United States of America and Canada, and it will be seen on reference to the table further on in this report that even under normal conditions the United States is by far the greatest consumer of kauri-gum.

In order to meet the requirements of many of the original vendors who were unable to wait until the gum was sold by the Government it was arranged to make a further advance of 20 per cent., free of all charges and deductions, to any of the vendors who were prepared to accept such a payment as a final settlement on account of the gum originally taken over on their account by the Government. Many of the diggers availed themselves of the opportunity, and up to date more than half of the original vendors have been settled with on this basis.

The scheme of purchasing gum in many different grades and holding it on account of the several vendors, with the subsequent regrading of the gum and its preparation for export, renders necessary a more complicated system of accounts than would be required if the purchases were made outright. By the Amendment Act of 1915 the Minister is empowered to make straight-out purchases of gum, and it is considered that all future purchases will be so made. A considerable quantity of the more valuable grades of the gum purchased has been regraded for market requirements in the store in Auckland and is ready for export. The gum taken over from the diggers was generally in a dry and satisfactory condition, with the result that the loss of weight by evaporation has been much less than was generally anticipated.

"FACE-DIGGING" OPERATIONS.

In last year's report it was explained that face-digging work was being carried on at Mangawai, south of Whangarei, and at Waiharera and Waihopo, in the northern portion of the Mangonui County. The operations have been steadily carried on during the past year, and a total area of 153 acres has been dug over and levelled off. The value of the gum recovered in the process of the digging operations has been sufficient to cover the cost of labour, administration, and incidental charges in connection with the conduct of the works.

As before pointed out, one of the main difficulties encountered in carrying on the face digging is the vast quantity of stumps and timber buried in the land. Wherever it is practicable the stumps are removed in the process of the digging operations as well as all the loose timber, as it is often under the stumps that the large deposits of gum are found. For the profitable carrying-on of the works it will be necessary to obtain some mechanical power for dealing with the timber, not only to assist in its removal from the ground, but also to facilitate the subsequent disposal of it. Of course, once the timber has been stacked on the surface of the ground for some time it can be easily disposed of by burning, but it may be found that this would be a wasteful proceeding.

Much consideration has been given to putting this timber to some economic use by extracting the gum which it is known to contain. The Dominion Analyst has made a special report on the subject, which will be dealt with later on.

Each area presents a special problem, and it has been found that a system of working suitable for one place cannot be rigidly followed at another, although perhaps the two places are not far apart.

Of the two areas being worked at Waiharera, one is being dug to the solid sandstone formation, and all the timber is being taken out and thrown on the surface. This is at the Big Flat: while at Pausina's Flat, only about a mile distant, quite different conditions prevail, and other methods of dealing with the ground are necessary. Here it is quite impossible to remove all the big stumps from the land in the process of digging, or to dig the land down to the solid formation. It has been found expedient to adopt a shallow system of digging, and to remove only the smaller stumps and loose timber. The area so treated will be more like a bush farm in its early stages of development than land for agricultural purposes, such as the Big Flat is. Pausina's Flat is very rich ground, and it is remarkable the improvement made to it by the draining which has been done in connection with the face-digging work. Some portions of the flat are at present growing a splendid healthy crop of *Phormium tenax*, and the land generally, after the application of lime, will be easily put under English grasses and make good dairy farms.

At Waihopo again, which is about sixteen miles north of Waiharera, the timber difficulty is a very great one. The land here is being dug to the solid formation, and all the timber removed is thrown up on the surface of the ground. The quantity of timber is considerably greater than at any of the other face-digging works, and in the event of some satisfactory process being arrived at for extracting the gum from it will prove very remunerative, as nearly all the timber here seems to contain a large proportion of gum. It will be advisable in the spring of the year to take steps to plant the land dug over.

With a view of testing the productivity of the land a small area of 12 acres at Mangawai was sown in oats, and also about 6 acres at Waiharera. At Mangawai half a ton of lime to the acre was used, as well as 1½ cwt. of bonedust and 1½ cwt. of superphosphates. The crop was not put in until late in October, owing to the fact that the ground was not solid enough to work earlier. A yield of a little over 1 ton to the acre was obtained at Mangawai. At Waiharera the crop was not successful. It was late in being put in, and very dry and windy weather was experienced. Added to this no lime was used, it being impossible to obtain any there at the particular time.

Full particulars of the expenditure under this heading are given in the accompanying statement of accounts.

KAURI-SWAMP PEAT.

As mentioned in the last report, considerable attention has been directed lately to the question of the profitable utilization of the kauri-swamp peat by the extraction of oils and other valuable products. Two syndicates have done a large amount of preliminary investigation-work in connection therewith, one of the syndicates being located in Melbourne, the other in Auckland.

In order to facilitate the development of the peat-oil industry provision was made in the amending Act of 1915 enabling the Minister to grant leases of areas, not exceeding 3,000 acres, to any person desirous of entering into this industry. The total area which can be set apart at any one time for such purposes under the Act is 10,000 acres. The Act provided for the making of regulations for the proper control of any such leases issued. Regulations have been gazetted enabling the provisions of this section of the Act to be brought into operation. The administration of any such leases, as the law stands at present, is in the hands of the Land Board.

NECESSITY FOR PROPER CLEANING AND STANDARD GRADING OF THE GUM.

The fossil kauri when taken from the ground is covered with dirt and encrustations of deteriorating gum. It is usually washed in the field by the digger, and the large pieces of the harder and more valuable sorts are further cleaned by scraping. The scraping is done by the digger at night or on wet days, a strong pocket-knife being used for the purpose. There are several degrees of scraping, each representing an additional trimming with the knife. These include "half," "three-quarters," "seven-eighths," and the "rescrape."

Much of the gum, however, is sold in the local market in its original dirty state, without either being washed or scraped. There is little or no scraping done in the stores in Auckland, and the consequence is that much of the gum is exported in a condition which does not result in the best value being obtained for it.

Scraping by hand is at best a slow, costly, and wasteful process. In any case it is only those pieces of hard gum which can be easily handled that are scraped; all the small pieces remain untouched. All things considered, it must be said that the cleaning and grading of the gum by the methods at present in vogue cannot be regarded as satisfactory. In the interests of the industry it is essential that all the gum should be exported in the best possible condition, and careful consideration should be given to any methods likely to achieve this end. A process which seems to promise good results is the sand-blast apparatus invented by Mr. F. V. Raymond, formerly of Invercargill. An experimental plant equipped in Auckland proved successful, and a factory was afterwards erected in Dargaville to clean the gum for the market.

The principle of the sand blast has been long known, and it is not difficult to comprehend its effectiveness in removing the outside crust or casing from the fossil gum. With a systematic spraying of sand over the gum under a regulated force of compressed air the cleaning should leave little to be desired. The apparatus in use by the inventor proves that gum of any size can be cleaned, and this is an important result in view of so much of the gum now produced being small in size owing to the fact that in the early days of the industry only the bold gums were dug. It is claimed that the cost of cleaning by this process is much lower than by any method hitherto used. The cleaning is thorough, and makes the subsequent grading of the gum a simple matter. The invention is described in the letters patent as a process for removing the exterior deteriorated coating from kauri and other like gums, consisting in subjecting the gum to the action of blasts of sand operated by compressed air; also an apparatus for

carrying out the process comprising sand-hoppers and blast-jets, trays for receiving the gum-pieces, a conveyer for moving the trays through a cabinet containing the blast-jets for cleaning the gum, and exhaust fan and pipes for withdrawing the gum-dust from the cabinet and passing it to a settling room, a sand-elevator for collecting used sand from the bottom of the cabinet and transferring it to the sand-hoppers for use again.

Not only is it important that all gum should be exported in the best condition, but it is also equally important that the grades of gum should be standardized. One of the largest exporters of kauri-gum in Auckland recently expressed himself most emphatically on this point. He said there was nothing in his opinion more calculated to put the export trade on a sound basis than the establishing of standard grades by the Government. He thought that about thirty grades would be sufficient to fill all requirements, and the introduction of Government grading would put an end to the existing unsatisfactory conditions, under which each merchant graded his gum according to his own particular fancy, having recourse to a grading which would be most profitable to himself.

It may be here pointed out that provision was made for the Government grading of gum in the Kauri-gum Industry Amendment Act of 1910 (*vide* schedule of Act referred to, amendment to section 30). Probably before long it may be found necessary to make provision for bringing the above section of the Act into operation.

KAURI-GUM, ITS USES, QUALITIES, AND PARTICULARS OF EXPORT.

Kauri-gum is found only in that portion of New Zealand lying between latitude $34^{\circ} 20'$ and $38^{\circ} 20'$. This region comprises all that area of the North Island to the north of a line drawn approximately from Kawhia on the west coast to Tauranga on the east. It is found in irregular-shaped pieces of much larger size than any of the other fossil resins, and in colours ranging from the clear-white range to the dark-brown and almost black swamp. It is externally dull in appearance, and in the best class of gum, known as "dial," the transparency varies in different parts of the same piece, striated, smoky, and cloudy portions being often seen in the same lump. Kauri-gum breaks with a conchoidal fracture, and the broken pieces have a fragrant odour which is characteristic of the gum. The specific gravity ranges from 1.70 to 1.80, and the melting-point from 380° to 460° . In destructive distillation the loss in weight is from 15 per cent. to 25 per cent.

Kauri-gum can be recognized from the true copals by its greater brittleness and resinous odour, but it is often very difficult to distinguish at sight between certain samples of Manila copal and some of the lower grades of kauri-gum.

Kauri-gum does not withstand the action of the atmosphere as well as the best of the copals or the Zanzibar animi, but makes a very good varnish of the best grade. Writing in 1880 on the subject of varnishes and fossil resins, Mr. R. Ingram Clark, F.L.S., said: "Kauri is extensively employed by the leading manufacturers in every country where varnish is made. The universal favour we by no means attribute to the superior results to be obtained by its use, but rather to the fact that it is easier to manipulate—that is, it unites with linseed-oil quicker, and at a lower temperature, than any other resin. It is probable that the essential oil it contains acts in the fusing process as a solvent; hence, less heat being necessary, carbonization is minimized, and a relatively paler varnish is the product."

Mr. H. Hurst, another recognized authority on the subject of varnish-making materials, and one-time lecturer on the technology of paints, colours, and varnishes at the Municipal Technical College, Manchester, in a recent work says, "Kauri does not make as good a varnish as copal, but being easier to melt, and the melted resin being much more soluble in oil, kauri varnishes are much easier to manipulate."

Bennett Blacker, Ph.D., in Allen's Analysis (Vol. iv), in discussing various resins, states, "Speaking generally, the greater the hardness the more valuable the copal. This generalization does not hold good for gum kauri. This resin has been extensively used in the varnish-making industry, not only because of the good results obtained, but also for the ease with which it can be manipulated by the varnish-manufacturers. There are other resins which melt at a lower temperature, but they have peculiar properties, and are not so easy to work."

It is thus evident that, besides possessing a general all-round excellence as an oil-varnish ingredient of high value, kauri has qualities absent in the other fossil resins, which make it easily soluble in oil and simple to manipulate, and these facts no doubt account for its universal use wherever high-grade varnishes are made. Assertions are frequently made by those interested in the export of kauri-gum that the kauri-resin as a varnish material will soon become a thing of the past and that the demand for it will steadily decrease. There seems little warrant, however, for such a conclusion, and the authorities quoted above make manifest why it is that kauri has so firmly held its own for so many years against all other fossil resins. In spite of all such assertions it may be declared with some confidence that the kauri-gum trade will continue to maintain itself as one of the important industries of the Dominion, certainly for another quarter of a century and probably longer. True there is no second crop coming in, and every shipment lessens the available supply, but the same may be said of all the fossil resins on the market. Consideration of these points suggest that it may be advisable before long to regulate the export of kauri-gum.

It is often stated by men in the gum trade that some varnish-manufacturers are using less kauri than formerly, and that others, having found a substitute, have dispensed with the use of kauri altogether. These statements may be more or less correct, and the explanation is probably that the manufacturers referred to are turning out an inferior varnish. The steady demand for kauri which is shown by a study of the export returns for many years should remove any misgivings there may be in some minds as to the future of the industry.

The following table enables a comparison to be made of the export for the decades ending 1904 and 1914 :—

Period.	Average Yearly Export.	Average Yearly Value of Export.	Average Value per Ton for Period.
	Tons.	£	£ s. d.
1895 to 1904	8,590	509,434	59 7 0
1905 to 1914	8,397	489,792	58 7 0

It is interesting to note that for the ten years ending 1914 the average price per ton is only £1 lower than for the previous decade, and this notwithstanding the fact that for the past twelve years about one-third of the total export has consisted of chips and dust, the grades of lowest value.

On reference to the subsequent table it will be noticed that the figures for 1913 and 1914 are well up to the average, being, 8,780 tons, value £549,106, and 8,473 tons, value £497,449, respectively.

Particulars of Kauri-gum exported from New Zealand from 1906 to 10th March, 1916, inclusive.

Country to which exported.	1906.		1907.		1908.		1909.		1910.		1911.	
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
United States of America	4,250	261,315	5,171	381,566	2,855	215,291	5,127	375,126	4,149	263,375	3,514	209,216
United Kingdom	4,286	233,530	2,468	162,121	1,799	123,011	2,290	140,235	3,253	151,319	2,378	130,767
Germany ..	513	21,065	936	27,473	667	23,841	639	24,111	913	28,016	1,142	34,062
Canada ..	39	2,660	53	4,512	21	1,646	24	2,555	66	7,687	9	1,061
Australia ..	33	1,822	42	2,216	155	6,458	149	8,576	66	4,465	75	2,559
Belgium ..	..	..	21	821	22	1,572	17	1,770	29	1,899	78	3,990
France ..	19	1,686	9	918	10	875	1	85	19	1,656	75	5,774
Austria-Hungary	9	357	..	..	1	104	1	68	124	3,011	131	3,968
Russia ..	..	..	..	..	..	..	..	..	15	1,976	80	1,859
Netherlands ..	1	41	1	114	..	..	..	..	6	133	55	1,206
Sweden ..	..	..	7	147	..	..	2	172	30	720	35	803
Italy ..	..	..	..	..	..	..	..	..	23	779	15	417
Japan ..	..	..	..	..	..	..	..	..	..	..	..	25
Fiji ..	4	10	..	..	..	..	..	..	..	..	..	..
Argentina ..	..	..	..	..	..	..	..	..	..	8	..	..
Totals ..	9,154	522,486	8,708	579,888	5,530	372,798	8,250	552,698	8,693	465,044	7,587	395,707

Country to which exported.	1912.		1913.		1914.		1915.		1916.	
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
United States of America	3,894	232,566	3,995	308,456	4,531	316,200	3,312	222,856	731	45,804
United Kingdom ..	2,468	114,640	3,390	187,547	3,335	148,370	1,172	48,585	245	9,697
Germany ..	1,053	32,964	833	27,880	373	21,193	..	..	..	..
Canada ..	40	3,370	62	4,618	70	2,114	56	4,550	115	8,576
Australia ..	39	2,487	80	3,933	19	1,720	9	594	5	299
Belgium ..	123	5,088	126	5,120	34	1,519	..	..	..	..
France ..	37	3,037	45	3,995	42	3,599	5	430	..	..
Austria-Hungary	159	4,611	112	2,617	14	329	..	..	..	..
Russia ..	2	184	53	1,725	3	225	21	2,118	..	..
Netherlands ..	42	974	60	2,495	8	664	..	..	..	..
Sweden ..	35	952	15	420	20	560	..	..	..	..
Italy ..	15	410	9	300	23	855	..	..	..	..
Japan ..	1	22	..	..	1	96	..	..	..	..
Fiji ..	..	..	..	..	..	..	..	..	..	..
Argentina ..	..	..	..	..	..	..	..	..	..	..
Totals ..	7,908	401,305	8,780	549,106	8,473	497,444	4,575	279,133	1,096	64,376

A brief analysis of the above figures is given below in tabulated form, and is of special interest :—

Period 1906–14, inclusive.

Country to which exported.	Total Exports.	Total Value of Export.	Average Yearly Export.	Average Yearly Value of Export.	Average Price per Ton.
	Tons.	£	Tons.	£	£ s. d.
United States of America ..	37,486	2,563,111	4,165	284,790	68 8 0
United Kingdom ..	25,667	1,391,540	2,852	154,616	54 4 0
Germany ..	7,069	240,605	785	26,734	34 1 0
Australia ..	658	34,236	73	3,804	52 1 0
Canada ..	440	34,773	49	3,864	79 1 0
Austria-Hungary ..	551	15,065	61	1,673	27 7 0
Belgium ..	450	21,779	50	2,420	48 8 0
France ..	257	21,625	29	2,403	84 3 0

It will be seen that the United States not only takes the greatest quantity of our output, but also the most expensive grades of gum, the average price per ton being £68 8s. as against £54 4s. for the United Kingdom. The comparatively low price of the gum exported to the United Kingdom is explained by the fact that the export includes a considerable proportion of low-grade chips and dust used in the linoleum-manufacture. In regard to the figures given for Germany and Austria it may be noted that these countries confined their trade almost exclusively to the linoleum trades.

RESINS WHICH MORE OR LESS COMPETE WITH KAURI IN THE VARNISH-MAKING INDUSTRY.

Amber.—This resin is found in small quantities in many countries, but the commercial supply comes from the Baltic provinces of Germany, from Russia, and from Burmah. It is obtained by fishing with nets during storms (small pieces being washed up by waves), by diving and dredging, and also by mining. In the latter case the resin is found in clay strata, which is brought to the surface and washed through large troughs. In colour amber varies from pale yellow to black, some specimens being transparent, others opaque, while cloudy varieties are also found. This resin has physical and chemical properties different from any other resin, and has the highest melting-point. It yields an excellent varnish, but is seldom used owing to its cost and the fact that it is difficult to manipulate. It is said that almost all the "amber" oils and varnishes now on the market are made from other fossil resins and not from amber. The specific gravity varies from 1.08 to 1.094, and the melting-point from 600° to 615° F.

Animi.—This resin comes from Zanzibar, being exported in both fossil and recent forms, and is only produced in small quantities. The fossil is found in the ground in depths up to 3 ft., in small pieces of varying size. It has neither taste nor smell, and makes the best oil varnish known, being unsurpassed for brilliancy and durability, and is used in all the best varnishes. It is of a yellow or brownish-yellow tinge, and in destructive distillation loses from 20 to 25 per cent. of its weight.

Animi is peculiar from the fact that when first dug from the ground it is covered with a red crust, on the removal of which small indentations appear on the surface, known in the trade as "goose-skin." The specific gravity is from 1.062 to 1.068, and the melting-point from 450° to 465° F.

Copals.—These resins are found on the west coast of Africa from latitude 8° N. to latitude 4° S., and are used in most of the better class of oil varnishes. They are fossil resins, and, with the exception of the pebble copal, which is found in river-beds, they are all found in the earth at depths varying up to 10 ft. Copals from different parts of the coast vary a great deal, and the varieties are known by the names of the country in which they are found.

In the trade the term "copal" includes not only the true copal but also *animi*, *manila*, *kauri*, and other resins. The following extract from the Commerce Reports issued by the Bureau of Foreign and Domestic Commerce, Washington, D.C., 20th December, 1915, shows the present magnitude of the trade in Congo copal:—

"It has been stated in previous reports that gum copal would in the near future probably become the chief agricultural product of Kongo, the exports during 1911 having been 2,101 tons; in 1912, 3,689 tons; and in 1913, 4,614 tons, thus surpassing the rubber exports in quantity. The rapid advancement in the interest taken in gathering the gum was due to its increasing size in the manufacture of varnish and the corresponding advance in prices. Upon this product the unsettled business conditions had little effect, the exports for the six months ended 31st January, 1915, having amounted to 2,739 tons, as against 2,659 tons during the corresponding months of 1913-14, a creditable increase, notwithstanding the lower prices offered on the European market. It is almost certain that the increase would have been much larger under normal conditions. Only small quantities of gum copal pass through Kongo in transit from the neighbouring colonies, 7 tons in 1914-15 and 5 tons in 1913-14.

"As a result of the low market prices the benefits to the traders in Kongo were small and the year's trade not as satisfactory as in 1913. The average price paid to the Native gatherers of the gum is only about 2 cents per pound, so that it cannot be considered as one of the rich natural resources of the colony; but the industry gives employment to many, and the trade is still capable of considerable development. In November, 1914, a shipment of more than 65 tons was made to the United States, this having been the first direct shipment to the American market. The amount realized thereon was very satisfactory to the local shippers, who appear to be interested in creating a permanent market there."

The principal copals are as follows:—

Sierra Leone.—This is the very best variety of copal found. It is found in rough angular pieces, almost colourless or of a pale yellow. It is largely used on account of its freedom from acids, and by a judicious selection of the resins makes a good pale varnish. Its specific gravity is from 1.055 to 1.068, and the melting-point from 330° to 400° F.

Pebble Copal.—This resin is found in the river-beds and comes in small round pieces, mostly colourless. It is the hardest of all the copals, but the supply is very uncertain, and it is not much used in good varnishes. The specific gravity is 1.055, and the melting-point 475° F.

Angola Copal.—This is found in Angola, Benguela, and Congo. It comes in small globular pieces, and is covered with a red crust. In colour it is mostly a very light yellow. It is not so hard as the other copals, but makes a fairly durable and good varnish, and is coming into more general favour than hitherto. The specific gravity is 1.065, and the melting-point varies a great deal according to the variety, but none of it is as hard as Sierra Leone or pebble copals.

Various other varieties of copal comes from Loanga, Accra, Gaboon, &c., but these are all very much inferior to Sierra Leone copal, and are not used in the best varnishes.

Demarara Copal.—This resin, which comes from British Guiana, is a copal in name only. It comes into the market in large pieces covered with a thick crust, and when cleansed is transparent

and homogeneous. It makes an excellent varnish, but in destructive distillation it gives off a large proportion of volatile oil and gas and leaves but little solid resinous matter, and therefore does not make as strong a varnish as the true copal or animi. The specific gravity is 1.030, and the melting-point from 450° to 465° F.

Manila Copal.—This is another resin which is generally referred to as a copal, although it is much more like the kauri than the copal. In fact, it takes an expert to tell the difference between some grades of Manila and the cheaper grades of kauri. It is shipped from Manila, but is found in various parts of the Malay Archipelago, and comes into the market in many varieties which are generally graded into hard and soft resins. It is chiefly sold at Amsterdam, the most of it going to Germany. Although the supply of the different grades keeps up, the qualities vary so much that they are very tricky to manipulate. This resin is seldom used in the best kinds of oil varnishes. The specific gravity is from 1.060 to 1.70, and the melting-point from 375° to 400° F.

Sandarac and Rosin.—These are used only in the cheapest of oil varnishes and cannot be considered as competitors with kauri. The former (specific gravity 1.038 to 1.044 and the melting-point 300° F.) is a recent and bled resin, and comes from the north coast of Africa. Rosin (specific gravity 1.044 to 1.100 and melting-point 212° F.) is also known under the name of "colophony," and is obtained in the distillation of turpentine from gum, the rosin being left behind in the still after the turpentine comes over.

CHIPS AND DUST.

The above low-grade kauri-gum has for many years been exported to Germany in considerable quantities, and the suggestion has been frequently made that it was being used in the manufacture of explosives. Samples of the gum were submitted to the Dominion Analyst, who has furnished the following report:—

"Wellington, N.Z., 29th April, 1916.

"REPORT on Specimen No. G/112 (1-3), forwarded by the Kauri-gum Superintendent, 7 Lower Hobson Street, Auckland. Particulars: Samples of kauri-gum, received in February.

"Your letter advised—'Box 1 contains pure dust; box 2 contains black chips and dust and white chips and dust (in bag).' The white chips and dust I have called No. 2 and the black chips and dust No. 3.

"When these three samples were burned they gave the following percentages of ash: No. 1, 51.4; No. 2, 3.3; No. 3, 33.5. These results show that while No. 2 consists mainly of gum, No. 1 contains less than 50 per cent. of gum and No. 3 not more than 66 per cent. of gum.

"With regard to the possibility of the Germans using such gums as these for the manufacture of explosives: No doubt kauri-gum could be used satisfactorily, especially in the manufacture of bombs, but it does not appear to have any advantages over ordinary resin, which is only £25 per ton, and should be readily procurable from Norway and Sweden if not from the United States.

"J. S. MACLAURIN, Dominion Analyst."

It is interesting to note in regard to sample No. 1 that it was a dust of the finest particles, about the consistency of ordinary wheat-flour.

KAURI-SWAMP TIMBER.

During the past year Dr. MacLaurin has continued his investigations with the object of ascertaining the proportion of gum contained in the swamp timber, and with a view to evolving some economic process of extracting the gum. Special attention has been given to the class of timber called by the digger "corned beef." This consists of roots, knots, and odd pieces thickly encrusted with gum. The digger usually removes any gum that can be easily chipped off and then casts the wood aside.

It will be seen by the following report that the results already obtained by Dr. MacLaurin are very encouraging, and fully justify further investigations being made.

"Wellington, N.Z., 19th April, 1916.

"REPORT on specimen No. F/919 (1-2), forwarded by the Kauri-gum Superintendent, 12 and 13 Warwick Chambers, Queen Street, Auckland. Particulars: Kauri-swamp timber, received in August, 1915.

"Your letter of advice stated—'No. 1 contains pieces from the field; No. 2 contains small knots and bark from the gum-sorting shed, known as "corned beef" by the sorters.'

"No. 1 consisted of fairly large pieces of timber without any adhering gum. Before timber of this kind could be successfully treated by an extraction process it would require to be reduced to a fairly fine state of division, which would largely increase the cost of recovering the gum. It was therefore thought advisable to defer the investigation of such timber until the much more promising material, such as No. 2, had been thoroughly tried.

"'No. 2, corned beef,' consisted of knots and bark. It weighed 23½ lb. The bark and most of the adhering gum were removed from the knots by hammering. The knots after this treatment weighed 9½ lb. and were rejected. The bark, &c., removed from the knots was ground to a fairly fine powder, a portion of the harder bark which did not grind readily being rejected. The ground material weighed 12½ lb. Portions of it were extracted with a suitable solvent and approximately 30 per cent. of extract obtained. This is equivalent to 16 per cent. on the original 'corned beef.' The extract is contaminated by substance other than kauri-gum, dissolved from the bark, but I think it may be possible by modifying the process to obtain a very much purer extract.

"I consider the results obtained are very encouraging, and I intend to continue investigations along these lines.

"J. S. MACLAURIN, Dominion Analyst."

There is a considerable quantity of this "corned beef" available at all the face-digging works, and it seems not improbable that before long the present waste product will be turned to profitable account, so adding another factor in the successful reclamation of these vast swamp areas.

BUSH AND BLED GUM.

In the early days of the industry—in fact, as soon as the fossil kauri became firmly established as a marketable commodity—attention was directed to the accumulations of gum known to exist in the extensive forests scattered over the North Auckland Peninsula. Strawn over the floor of these forests gum was found in large quantities mixed with the leaves, bark, and decayed wood and other vegetable matter just as it had fallen from the tree. At the base of some of the larger trees these accumulations had formed mounds several feet in height, and so the crop of bush gum was not only abundant, but was also easily gathered in.

No doubt it was the pioneer settler living on the fringe of the forests who first realized the value of bush gum. It did not, however, get a favourable reception on the Auckland market, where it brought only about one-third the price ruling for the harder "white range." There were times indeed when "bush" was quite unsaleable, but the prejudice against it steadily disappeared, it became sought after, and the price went up accordingly.

In the course of time this easily gathered crop began to be exhausted, and the attention of the gatherer was turned to the tree itself. Then the exploring and cleaning of the tree yielded an abundant harvest for many years. On many of the trees long yellow masses of resin resembling barley-sugar in appearance hung down from the limbs, while between the forks and on the barrels considerable quantities were found. On some of the giant trees so great were the deposits of gum that often they had to be dug out with a spade.

The men engaged in collecting the gum from the trees were known as "climbers," but their methods in the early days of the business were somewhat primitive. Usually two men worked together, one doing the actual climbing and the other remaining on the ground to gather up the gum as it was detached from the tree by his mate. For the purpose of making the ascent of the tree a weight attached to a strong fishing-line was thrown over a convenient limb; this done, a manila rope was attached to the line and hauled over the limb. The climber then worked his way up the rope, and by following the same method explored the whole of the tree. He usually carried a small tomahawk with which he chipped off the gum, which he allowed to fall to the ground. In the event of finding a large deposit in a fork or hollow he lowered his line and hauled up his spade. As time went on and the gum became scarcer more care was taken in saving it, and the gum as chipped off was placed in a bag and carefully lowered to the ground.

It can be easily imagined that the climber was not at all particular in his methods of chipping off the gum, and the consequence was that the trees were hacked and cut in a most indiscriminate manner. The climbers soon began to notice how freely the tree gave off its gum wherever a cut had been made, and it was not long after that the cutting or "bleeding" of the tree became a recognized practice of the climber. For many years bleeding was permitted both in the State and privately owned forests without restriction or control.

The earlier climbers were wont to classify the kauri into four classes, each with its particular bleeding characteristics. The first produced little or no gum. The second was known as the "dropper" tree, from the fact that the gum exuded from the branches and fell to the ground around the tree. The distinctive features of the dropper tree was that it had a prolific growth of branches; some of them had only short trunks, while others grew to a great height with a clear barrel of often 50 ft. to 100 ft. from the ground to the first branch. This tree was notable for producing the largest quantities of gum of the hardest and best qualities. The third class of tree was straight and tall but with comparatively few branches. It shed but little gum from the branches, the main flow taking place low down the barrel and at the roots. This tree was noticed to be subject to dry rot; the decay seemed to commence at the base of the tree and worked its way upwards. As soon as the decay started gum began to leak out, often in large quantities, hence this gum as known as "leak." In trees of the fourth class the gum was found in streaks on the barrel, somewhat resembling the grease on a candle which had been burning in a strong draught. "Candle" gum was found in various colours, from pure-white to light lemon, and from deep yellow to amber and dark brown.

The indiscriminate hacking and bleeding of the kauri above referred to continued for many years, and irreparable damage was done to the trees. When this began to be realized measures were taken to put an end to the practice as far as the State forests were concerned. In the absence of any control or proper system of bleeding the decision was a wise one. Bleeding was, however, continued on private lands, and of late years has been extensively practised with satisfactory and profitable results. Experience has proved that it is possible to conduct the bleeding operations in such a way as to do no appreciable damage to the tree. The men engaged in bleeding the trees are still known as "climbers," and have become exceedingly expert at the work.

The modern "climber" is equipped with a pair of 12 in. climbing-hooks; a pair of strong wooden clog boots, to the soles of which are affixed saw-teeth spikes and a strong spike projecting to the front; a 2½ lb. axe, and a manila rope 1½ in. in circumference completes the outfit. The rope is generally from 180 ft. to 200 ft. long, and at one end is provided with a seat similar to a boatswain's loop. Having selected his tree the climber secures one end of his rope to his shoulder, firmly fixes his axe in his belt, and then with the aid of his climbing-hooks and spiked clogs quickly and skilfully mounts the tree. He reaches his first stopping-place, often over 100 ft. from the ground, in fifty or sixty seconds. Arrived there, he runs one end of his rope over an upper bough and pays out the rope until the "boatswain's loop" comes up to him. He then takes his seat and proceeds with the "tapping," working his way

gradually down the tree. He makes a V-shaped cut in the bark, the V lying horizontally across the barrel of the tree; this cut is called the "tap," and is made deepest at the apex, there almost reaching the sap. The taps are cut horizontally around the limb and barrel of the tree, and are spaced about 18 in. apart. Having completed all the tapping that can conveniently and safely be made at his first level, the climber lowers himself 6 ft. or 8 ft. and again makes his circuit of taps, and so on down the tree.

Some forests are leased for bleeding purposes with the stipulation that no "taps" are to be cut in the barrel of the tree, so as to prevent all risk of damaging the tree for sawmilling purposes; others are let without any restriction, and the whole of the tree from top to bottom may be tapped and bled. The former system is called "bleeding heads only," and the latter "bleeding heads and barrels."

The climber when dealing with the barrel or trunk of the tree is required to exercise greater care in making the incision so as not to damage the wood of the tree.

After the tapping is completed the tree is left undisturbed for six months. The climber then makes another ascent of the tree. This time he has added to his outfit an oblong box measuring 12 in. long, 9 in. wide, and 9 in. deep. This box is constructed of wood and canvas, and is held under the tap, and the exuded gum chipped off with the axe. The tap having been cleared of gum is again opened, and the V is left as it was originally. The opening of the tap means the peeling and shaving off with the axe of about a quarter of an inch of dead bark, and so again exposing the green. It is always the original tap that is opened, it being quite unnecessary to make any new cuts. Every tap having thus been dealt with and the crop harvested, the tree is left for another six months and then the same process is repeated.

The first crop produces larger gum than the succeeding ones. Some of the gum is, however, soft, and needs to undergo a drying or hardening process. In each succeeding crop the gum tends to decrease in size but to improve in quality, bleeding harder and clearer.

After the gum has been gathered from the tree it is carried to the climber's camp. It is there carefully examined and any bark or rubbish picked out. The soft gum is spread out on a table having a wire-mesh top and placed in the sun to dry. After being thoroughly dried it becomes as hard as the ordinary gum. The cleaning and drying having been completed, the gum is then ready for the local market, where it is sold under the name of "bled bush."

It has been mentioned above that it is possible to bleed the kauri without doing any appreciable injury to the tree. In order to attain this result, however, it is necessary that great care should be taken in cutting the taps so as not to expose the sap-wood, for if the wood is exposed it lays the tree open to the attack of the pin-worm grub. When it is only the head of the tree—the non-marketable portion—which is bled there is no danger of any injury to the barrel of the tree by the ravages of the grub.

In many privately owned forests the right to bleed the barrels as well as the heads is frequently granted to the climbers, and it has been found that by the exercise of reasonable care the barrel can be tapped and bled without depreciating the marketable value of the tree for building purposes. It has been noticed that the bark at every tap quickly starts to repair the injury to its surface, and so rapid is this healing that if a carefully cut tap is left undisturbed for two years evidence of it has almost disappeared.

Having regard to the high and increasing value of bled gum, it is difficult to say what it will be worth in ten or twenty years from now. Indeed, it may be well conceived that the real value of the kauri-tree to the State lies in the periodic crop of gum which may be taken from it, and not in the timber the tree contains. It is estimated that for every million feet of milling timber in a forest a net annual revenue of £75 could be obtained by tapping the trees for gum. This estimate is made on the basis of bleeding only the heads of the tree, by which process, as already pointed out, the chance of any permanent injury to the tree is reduced to a minimum.

An instance of the successful bleeding of a kauri forest has been recently brought under my notice. In this case the trees had been systematically bled for the past ten years. The trees were bled "heads and barrels," and the tap cleared three times a year. The yield of gum at the end of the period was not much less than in the earlier years. Now, if the taps had been cleaned only twice a year and only the heads had been bled it might reasonably be concluded that the bleeding could have been continued for at least thirty years without doing any more injury to the tree than was done during the ten years.

It is of course recognized that bleeding is not looked upon favourably by many people; but it is remarkable how little reliable information can be obtained as to the effect of systematic and judicious bleeding on the marketable value and durability of the timber. It was thought that something definite on the subject could have been obtained from the report of the Royal Commission on Forestry (C.—12, 1913), but it was found that no reference whatever was made to the subject in the body of the report, although some of the witnesses were questioned regarding it. None of the witnesses went beyond the expression of a general opinion; proper and systematic bleeding does not appear to have been discussed.

At the present time the State owns two large areas of kauri forest, the Waipoua* and the Warawara. The former, which lies a few miles to the south of the Hokianga Harbour, contains 23,000 acres, and the latter, which is situated to the north of the harbour, has an area of 12,500 acres. These forests, in addition to the kauri, contain a variety of other trees, including rimu, miro, taraire, kahikatea, and totara, with the usual luxuriant undergrowth.

The Waipoua is estimated to contain 65,000,000 ft. of milling-kauri, and the Warawara 53,000,000 ft. Here, then, we have 118,000,000 ft. of milling-timber, which on the basis of £75 per 1,000,000 ft. mentioned above, would yield a net annual revenue of £8.850 by bleeding only the heads of the trees.

* For a full description of Waipoua, see Report on Botanical Survey of, by Dr. Cockayne (C.—14, 1908).

As a result of careful inquiries I am satisfied that this is a conservative estimate. At the same time I am well aware that the bleeding rights on the privately owned lands have hitherto been let for merely nominal sums.

The question at once arises as to how long the bleeding process might be continued. This would, of course, depend very much on the system adopted. If the trees were given periodic rests the bleeding might be continued indefinitely, for it has been noticed that if a tree is given a rest it seems to recuperate rapidly. As far as can be ascertained about 75,000,000 ft. of privately owned kauri has been bled, and the practice is still in vogue in several of the bushes. In most cases the trees have been bled "heads and barrels." It is admitted that under the system of bleeding "heads" only not more than 75 per cent. of the trees are bled, as experience has shown that in the case of trees of less than 2 ft. in diameter the heads do not yield sufficient return for the labour.

It is suggested that the careful bleeding of the kauri in the State forests, under proper management and on scientific lines, presents a practicable scheme for the preservation of the existing State kauri forests for perhaps centuries to come, for if the forests are yielding a good revenue it does away with the argument so often urged, that the timber should be cut down so that the land would become productive.

A statement of accounts in accordance with the requirements of the Kauri-gum Industry Amendment Act, 1914, is submitted herewith.

The Under-Secretary of Lands.

R. P. GREVILLE,
Kauri-gum Superintendent.

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