

LIGHT RAILWAYS

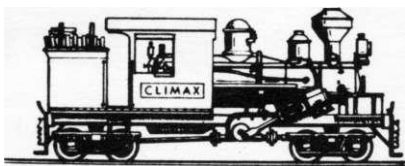
**April 1980
Number 68**

BRITANNIA CREEK

By A.P. WINZENRIED

Registered for transmission by post as a Periodical Category B





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August, 24 October, 12 December.

No68

Vol. XVII

APRIL

1980

ISBN 0909340 12 9

Whilst every effort is made to ensure the accuracy of articles published in *Light Railways* errors may creep in. Additional information is being discovered all the time, and this sometimes contradicts previous information.

If you see any errors, or can add information, please contact the editor, and so help us to record the full history of Australia's light railways.

Historical references to sums of money in *Light Railways* are in Australian pounds (£). One pound equalled two dollars on changing to decimal currency in 1966.

Articles and news items are always welcome. It greatly assists the editors if they are typed or written on one side of the paper only and double spaced.

Note on photographs in this issue.

Unless otherwise noted, all photographs are from originals provided by Cuning, Smith and Co. Those indicated by an asterisk (*), are from a Company collection photographed by Mr A.J. Sears, Collins Street, Melbourne, in 1917. Captions for those photos are those of the collection.

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ON THE COVER

Britannia siding on the official opening day of the Works; 23 November 1907. The Company had hired a special train to carry its officials, M.P.'s and the employees of its Yarraville plant to a special diner at the Britannia Creek plant. "Westward Ho", conveyed the 650 passengers from the broad gauge siding to the new plant.

Photo: A. R. Lyell Collection.

BRITANNIA CREEK

by A.P. WINZENRIED

Located in the hills 47 miles (75.5 Km) east of Melbourne, close to the now abandoned, Lilydale to Warburton broad gauge railway, is the site of the Britannia Creek Wood Distillation plant. Once it was the only commercial distillation undertaking in Australia, forming an important part in the organization known as Cuming, Smith and Co. Today, the company remains but the plant does not. Though the company operated more undertakings than that at Britannia Creek, it was their wood distillation interest that brought them the greatest publicity. Other Cuming, Smith works were located at Yarraville and Port Melbourne, in Victoria, and at West Guildford in Western Australia.

The Britannia plant was located adjacent to the creek of the same name some 2.5 miles (4Km) from the

5ft 3in gauge Victorian Railways line. To move products from the plant to the railway, Cuming, Smith and Company operated a steel-railed tramway. Further tramways were built to log the area and provide wood for distillation.

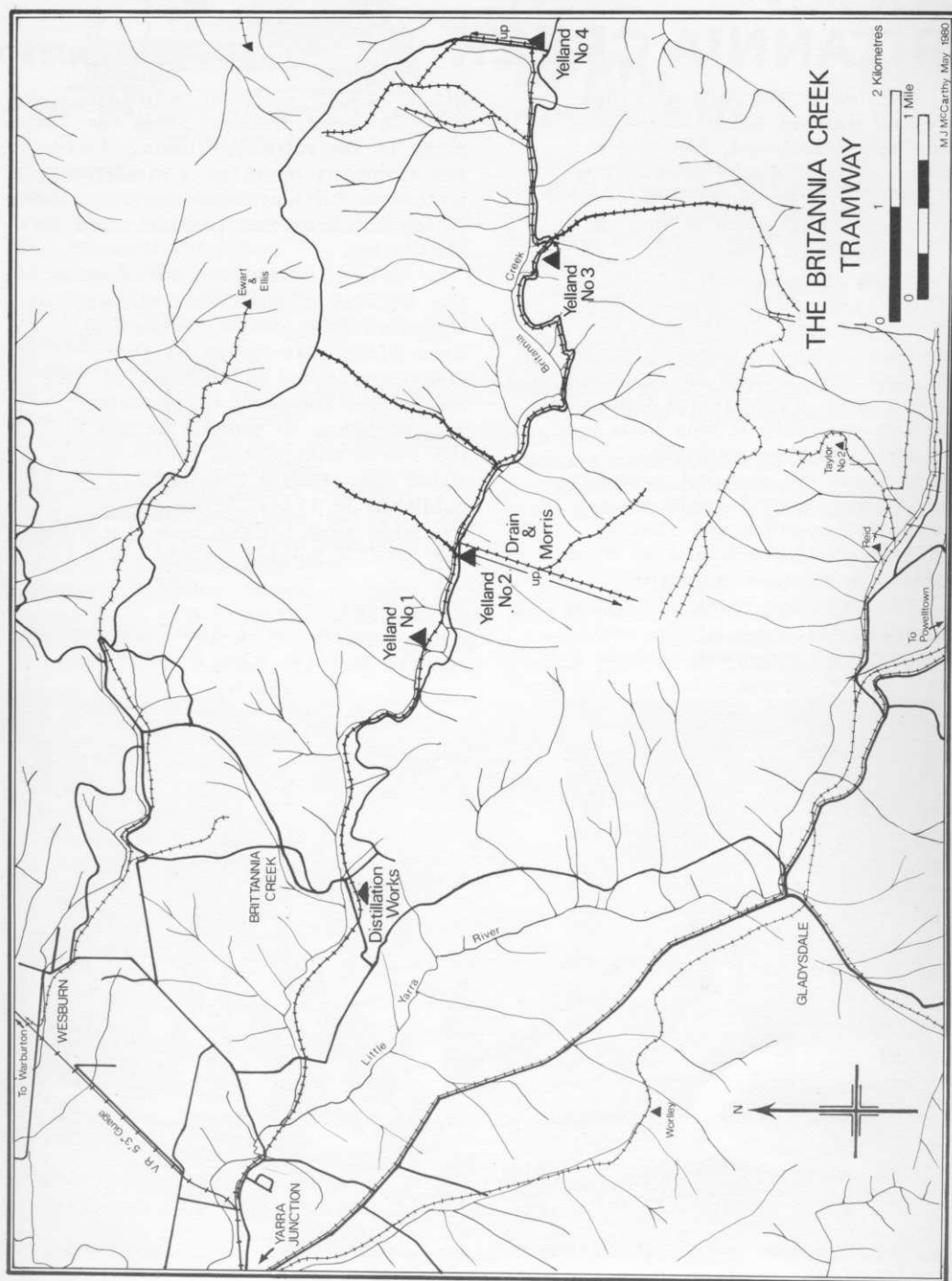
So significant was the work of the distillation plant that visiting engineers from outside Australia were often entertained by the management and given tours of inspection. Special printed matter was published to provide details of the works and process including one titled "Our Forest Industries", published in 1924. (Currently available as a LRRSA reprint through the LRRSA Sales Dept.)

Early Beginnings

Cuming, Smith and Company was formed in 1872, when Charles



9. Horse power on one of Yellands tramlines, c.1929. Photo - LRRSA archives.



Campbell and James Cuming Senior, took control of the assets of Robert and Alexander Smith, then trading as Robert Smith and Son. The Smith concern operated a Sulphuric Acid plant at Yarraville, near Melbourne. Under the direction of James Cuming, the new company began a period of intensive upgrading and expansion. Chemicals other than Sulphuric acid were produced, while moves into fertilizer manufacturing were initiated. A part of this expansion was the building of a major chemical works at Britannia Creek using the wood distillation process.

Similar plants existed in England and on the continent. These successful plants were thoroughly examined by James Cuming before he began work on his own plant. There were three essential prerequisites for the successful distillation of wood; abundant raw material for

distillation, fuel for the furnaces, and an adequate supply of water for cooling, steam raising and condensing. Britannia Creek valley supplied all these requirements and in 1906 work began on the construction of the plant there.

Supposedly, the area received its name from a certain ex-Royal Navy midshipman, Charles Bowtell. Retiring from his ship, the H.M.S. Britannia after the Crimean War, Bowtell settled in the valley, then a declining gold prospecting area. To support himself, he carried on a vigorous and successful trade in "spiritous liquours" based at a shack named after his ship, "The Britannia". As a result, the area was soon widely known as Britannia and the creek itself as Britannia Creek. The official name for the area was Tarrango (thence the current road name there, Tarrango



12. Britannia Siding in 1917. The tram from the distillation plant is on the right while the transshipment dock is to the extreme left.

Photo; LRRSA Archives.

Road), given to the locality when it was surveyed for selection in the 1870s. However, by 1907 it was more widely known by its unofficial name, Britannia.

Cuming, Smith and Company commenced operations at their new wood distillery on 16 August, 1907. Total cost of building the plant had exceeded 50,000. Working to capacity 60 - 100 men were employed distilling around 20,000 tons of wood each year, and processing the resulting chemicals.

The Tramways.

To service the works complex, two interconnecting tramways were built. Both were of 3ft gauge and laid in steel rails for the most part. While motive power was usually provided by horses a small steam locomotive named "Westward Ho" operated on the line from the opening of the plant until around 1915.

Commencing at the works one tramway headed toward the Victorian Railways 5ft 3in gauge line to Warburton. Leaving the plant site this tramway maintained a fairly even grade through timbered country towards the township of Yarra Junction (the terminus of the Gilderoy and Powelltown tramways). It crossed the Little Yarra river en-route and shortly after, joined the old Lilydale to Warburton road approximately half a mile (0.8 Km) from the broad gauge line. Following along the north side of the road the tramway covered the remaining distance to connect with the broad gauge a little less than a mile east of Yarra Junction.

At this point the V.R. line turned almost 90 degrees, from an easterly direction to head north around the edge of a ridge. In 1907, the Victorian Railways opened a dead end spur at a point adjacent to the

tramway naming the location, Britannia. It is more frequently referred to as Britannia Siding, although railway records persevered with "Britannia". The tramway approached the government railway at an acute angle, having to reverse back into the transhipment sidings provided. This section of tramway, between the plant and Britannia siding, was steel railed throughout, and, for the most part of its life, fairly well maintained. Loading on the line was quite considerable.



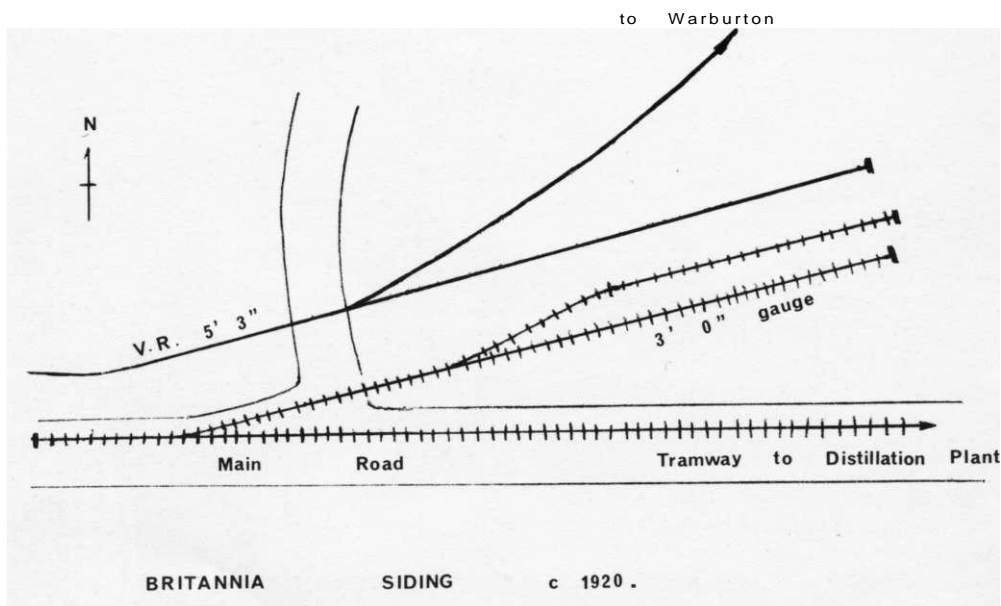
1. Foot of the incline leading to "The Breas" and No. 1 mill.

Photo; LRRSA Archives.

Even in 1910, 12,089 tons of goods were transferred to broad gauge trucks and railed out.

The second tramway headed east from the distillation plant with the purpose of timber getting. Initially a grade was laid out following the route of the present-day road to a point near the Britannia falls about three miles (5 Km) east of the distillation plant. This section of tramway was later replaced by a line which climbed gradually up the side of the ridge before arriving at the foot of a steep rise. From this point, a steep incline took the line up a steadily increasing grade to reach an elevated valley known from gold seeking days as "The Breas". The incline was double tracked and

operated with steel cables and a steam winch. Located close to the top of the incline was the No.1 Mill, a Yelland operation run in cooperation with Cuming, Smith. A moderately level area at this point served as an open-air seasoning and stack area (considerable timber stocks were also held adjacent to the distillation plant). Large amounts of timber were stored here before being moved to the mill to be distilled, or, if better quality, to the seasoning works. From No.1 mill, the tramway continued eastward, ascending the range in a series of steep inclines to reach three further mills. The most distant mill, No.4, was some seven miles (11.3 Km) distant from Britannia



siding and the V.R. These four mills were operated and owned by a Mr. J.Yelland. From each mill, further, minor tramways extended into the bush to allow harvesting of timber. Winch haulage was commonly used on these lines, while horses provided

the motive power above No.1 mill.

Complete harvesting was the goal of the operation as even partly decayed timber could be used for distillation. Anything in a transportable condition was usable, at least in theory. In practice, at

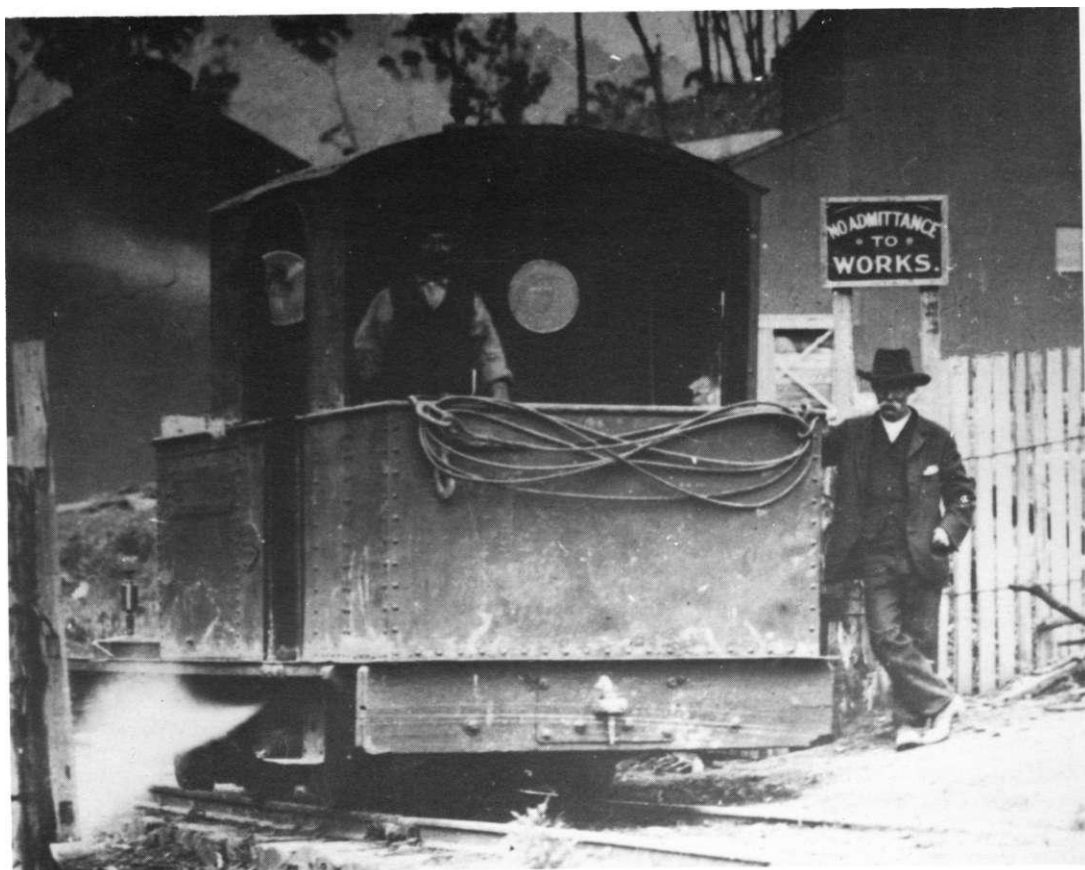
least some deteriorated wood was used as the photos demonstrate.

THE STEAM LOCOMOTIVE.

With the opening of the plant in 1907, Cuming, Smith and Company operated their tramways with horses and a small steam locomotive. This loco, a Fowler 2-4-0T, named "Westward Ho", hauled the opening train bearing guests to a large dinner at the plant after collecting them from the V.R. train at Britannia siding. It continued to be used until 1915 when it was stored under cover and out of service at the plant. From August 1915, horses

took over all duties on the tramway (other than the inclines, naturally enough!), and this continued to be the case until the tramway ceased operations in the late 1930's. After the works closed the locomotive was reportedly cut up on site. The exact details of this are not certain but sometime between 1924 and 1926 is most likely.

The locomotive's origin is an interesting point but a rather uncertain one. A locomotive of identical appearance and bearing the same name operated on a tramway at Forrest in the eastern Otways until 1907. That tramway, owned by Sanderson and Grant, however, was of



5.The entrance to the distillation plant with "Westward Ho" in the foreground.

Photo; N. Wadeson collection.



17. *Steam driven drag saw, sawing waste mountain ash into 3ft lengths for splitting into retort wood at No.2 mill. The decayed nature of some of the logs can be seen. Notice the moving bench (on wheels) enabling the logs to pass under the drag saw. Mr. Tom Richards at the drag saw, Mr. Frank Edwards in the log yard.

3ft 6in gauge which would have required a change of gauge for the loco to have been suitable for the 3ft gauge Britannia Creek line. As the Forrest loco was disposed of in 1907 to an unknown buyer, and the Britannia Creek loco appeared there in August 1907, there exists a strong possibility that the two locos are one and the same.

However, the necessity of re gauging the loco and the short time allowed for the alteration have caused some doubt to be thrown on this theory.

Fowler did usually build their industrial and light locomotives in such a way as to make re gauging possible. That operation on the loco in question should have presented few difficulties. As shown by the

care and money put into the Britannia Creek operation, any cost involved in regauging a small steam loco would have been considered unimportant.

However, there still exists that element of doubt which may one day be resolved but which cannot, at this stage, be dismissed.

The locomotive's short life at Britannia Creek may argue for a well used secondhand locomotive such as the one at Forrest, but it is impossible, at present, to be certain.

WOOD DISTILLATION.

As its main aim, wood distillation was to use otherwise useless wood to produce a number of

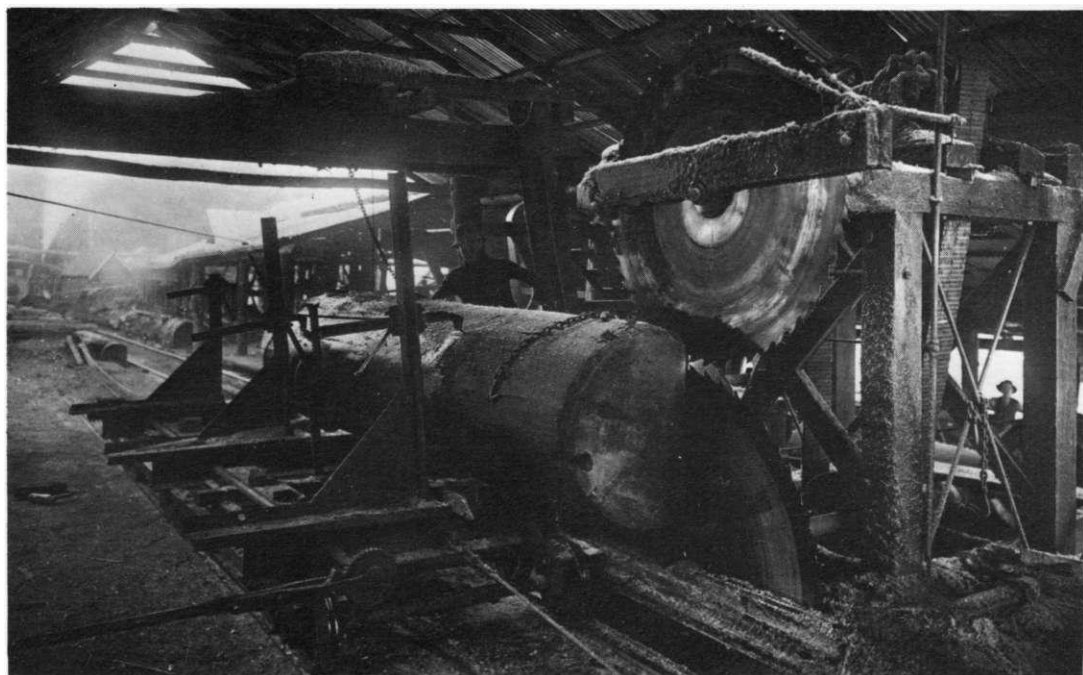
natural chemicals. Wood not suitable for other purposes such as building materials, palings, posts, rails, etc. could be subjected to a process of destructive distillation, with conversion of the many chemical compounds thus obtained into useful commercial commodities. Hardwood timber harvesting in Victoria at the time was a generally wasteful process. A tree that could take fifty years to reach a suitable size could be felled in an hour. Once on the ground, it could be seen to be totally unsuitable for the immediate need and would therefore be left to rot.

Sawmilling used only a portion of the tree. The head with its large limbs was usually left in the forest while the heart wood was often burnt at the mill.

Wood distillation allowed little waste. All parts of the tree - trunks, limbs, and branches - could be used, while heart wood was

most suitable for firing the furnaces to carry out the process. Almost any sound, dry timber, especially *Eucalyptus Regnans* (Mountain Ash), was used, but, due to the high moisture content, a long period of drying was necessary. Trees were usually felled in the Autumn when they contained the least sap. A growing tree contains as much as 50% water or more. In order to obtain dry wood, the incoming timber at Britannia Creek was stored either at "The Breas", or at the plant. Stacks up to half-a-mile in length and aggregating 12000 to 15000 tons each could be seen at the plant when it was in full operation.

On arrival at the mill yard, logs were sorted. Every log with commercial value as building timber, etc. was fed into the mill to be broken down. While inferior timber went to the steam driven drag saws for breaking down into 3ft lengths. These log lengths were further split



19. *Breaking down saw bench, No.2 mill.



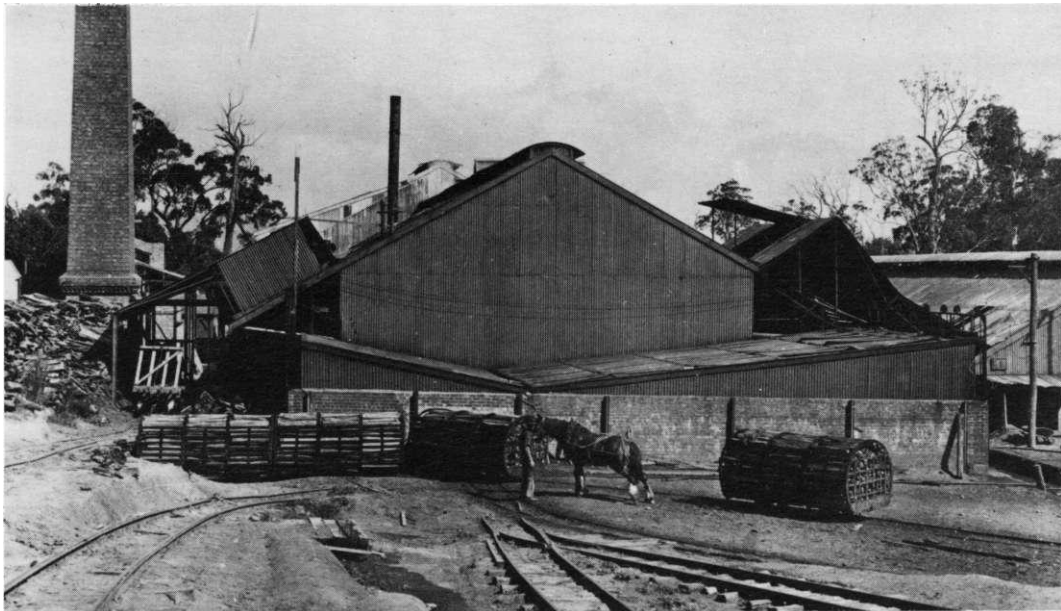
26. *Retort wood, wood shed for use in wet weather.
Distillation works in the background.

to 4in x5in x3ft billets before being loaded onto tramway bogies and removed to the drying stacks. There, the billets remained for about eighteen months by which time their water content had dropped to around 12 or 15 percent.

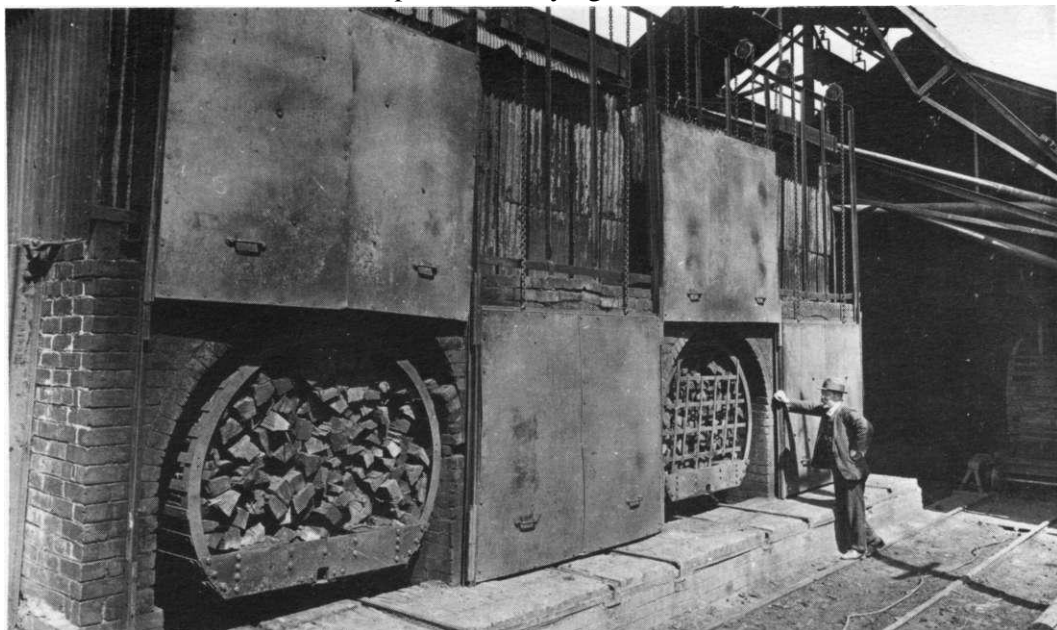
Once dried to this stage, the billets of retort wood were loaded into circular wrought iron cage trucks, each holding about three tons of wood. From the drying stack area, the cage trucks were hauled one-at-a-time by draught horse, to a holding yard adjacent to the plants drying chambers. Five different tracks converged at this point, terminating in a single-tracked, iron turntable. From the turntable a track ran in front of the drying chambers on a three-railed traverser which ran the entire length of the main building. Loaded trucks were

rolled onto the traverser and then loaded into the drying chambers. Each chamber took four trucks. Once loaded the brick chambers were filled with hot gases to heat the wood to 100 degrees centigrade until the wood was sufficiently dry for distillation.

Once dried, the timber was moved via the traverser, to the distilling retorts. These retorts were about 40ft long and 7ft in diameter. Again four cage trucks made up the normal load. The time taken for a single charge of 12 tons to distill was 30 hours, and the residue, as could be expected from a controlled combustion process, was charcoal. In this process more than forty different chemicals were formed, some liquid, some gaseous. With distillation complete, the trucks were drawn out of the retorts



27. *Close up view of works, showing drying chambers built with bricks, turntable where all tramlines met, and retort cage trucks loaded and about to be placed in drying chambers.



28. *Drying chambers open and closed, the general manager, and the traverser track. A traverser carrier is seen just inside the doorway.

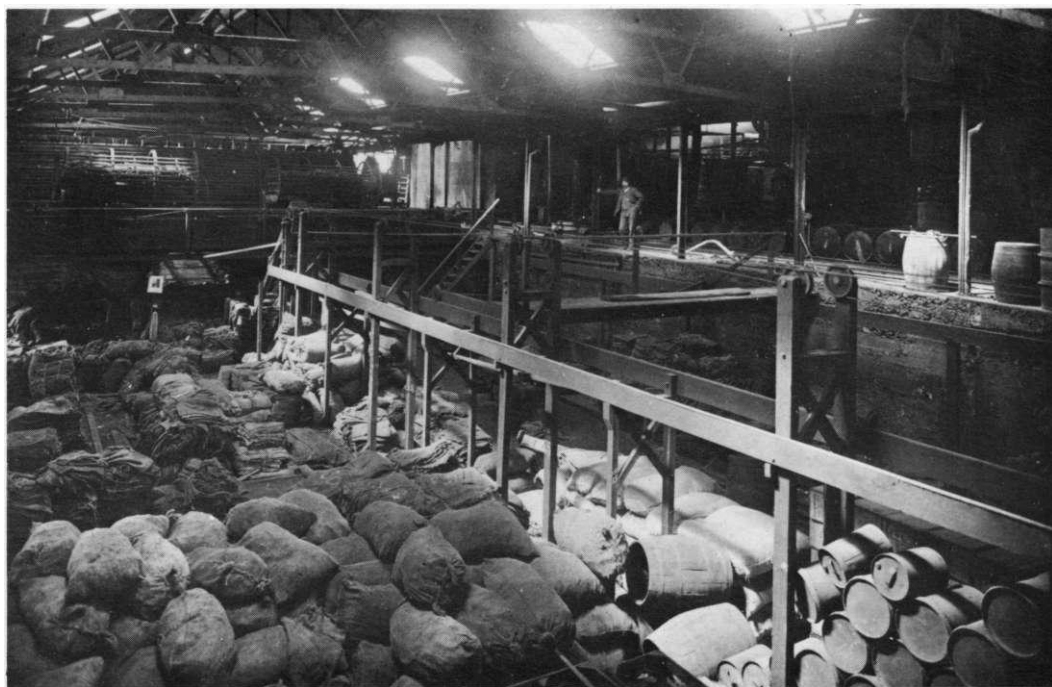
by a steam winch and run into a cooling chamber, where the charcoal was thoroughly cooled. It was then bagged ready for shipment by tram to Britannia siding.

The gaseous portion of the distillate was used as fuel under the retorts themselves and in the drying chambers. The liquid part consisted of water principally together with acetic acid, wood spirit, tar and creosote oils. It was known as pyroligneous acid and was collected in large vats for treatment.

Reference to the flow chart at this stage will show the various products and the order in which they were extracted from the pyroligneous acid residue. By chemical processes the tar and tar oils were separated from the rest of the material and, after being refined, were filled into barrels for sale. Tar was used

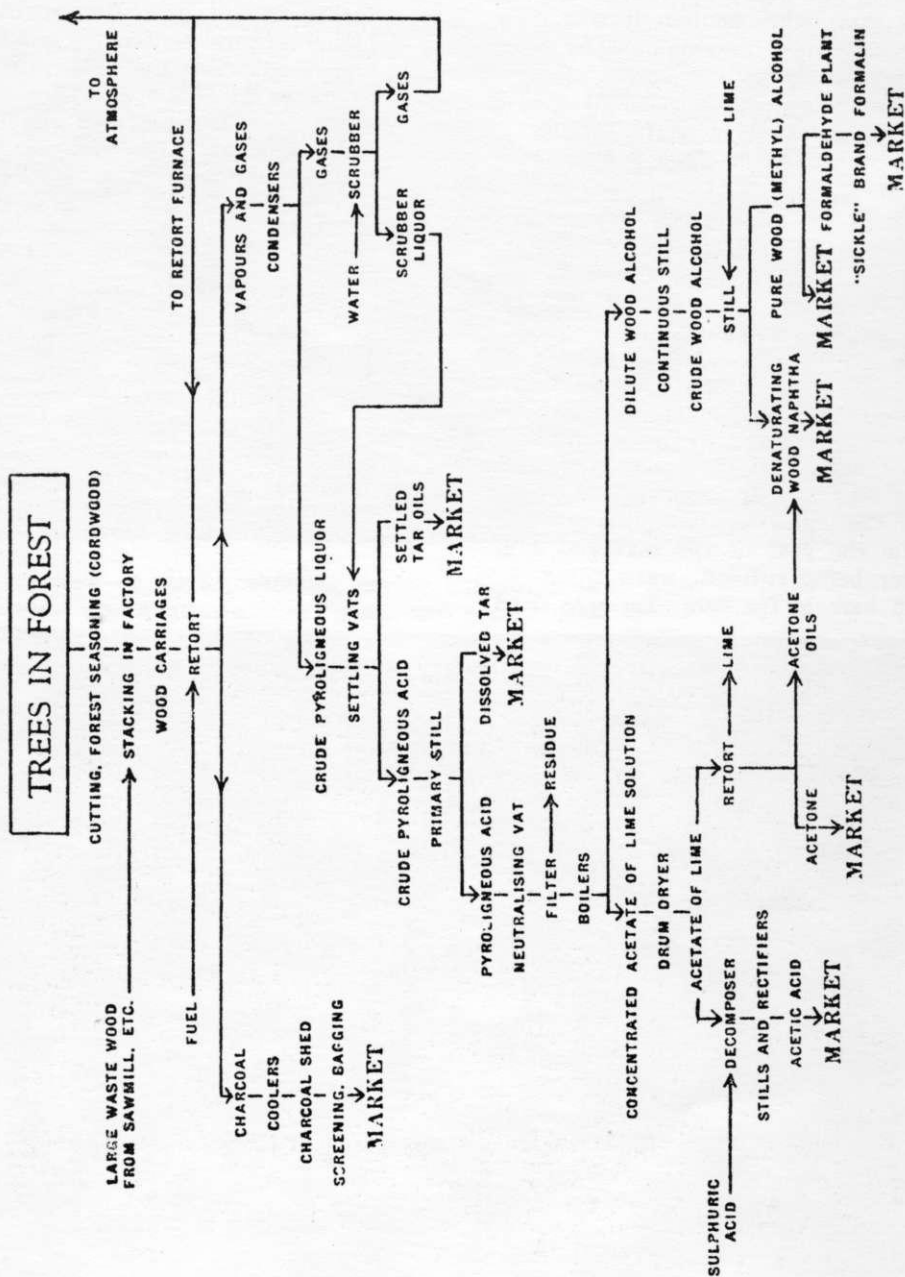
for treating woodwork exposed to the weather or converted to pitch by further distillation. Due to the high creosote content, a product known as "creo tar" was also produced at this stage.

Once freed of tar oils the remaining distillate was conveyed to neutralizing vats to be treated for acetic acid. In order to separate the acetic acid from the wood spirit, lime was added until the solution was neutralized. The acetic acid united with the lime to form acetate of lime solution. This liquor was pumped through a filter press and any sand, clay, or insoluble matter in the lime thus removed. The wood spirit could then be separated from the acetate of lime by distillation. For this work, large



29. *Bulk storage for bags, crates, drums, etc. and charcoal discharging platform.

The Flow-sheet below serves to illustrate the order in which the chemicals are extracted by the Wood-Distillation process.



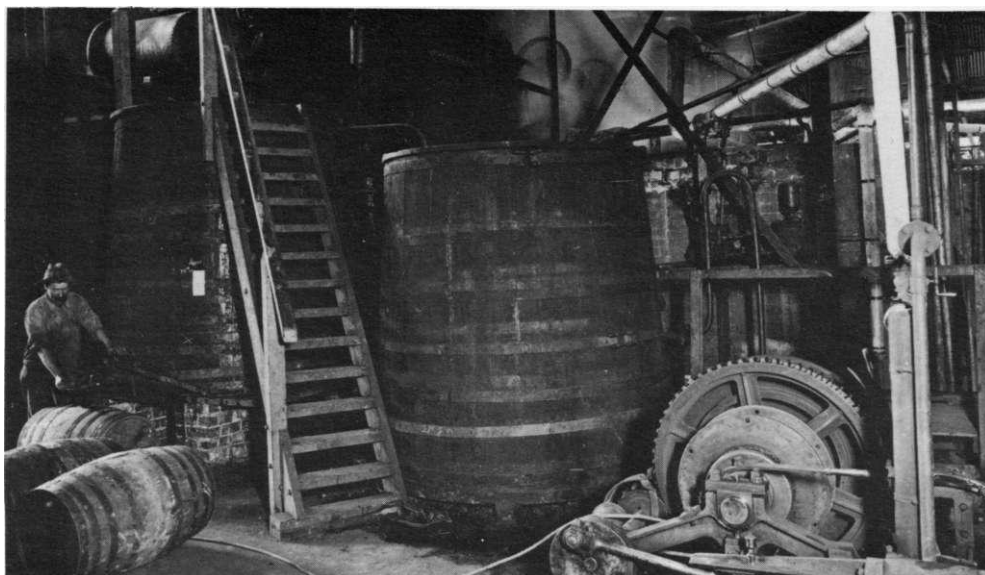
boilers and fractional stills were used, while the liquid which was distilled off was known as crude wood spirit.

With the use of triple effect evaporators and finally, large open pans (a rather hazardous occupation for the employees) the acetate of lime solution was dried. From this dried product, either pure acetic acid or pure acetone could be produced with little trouble.

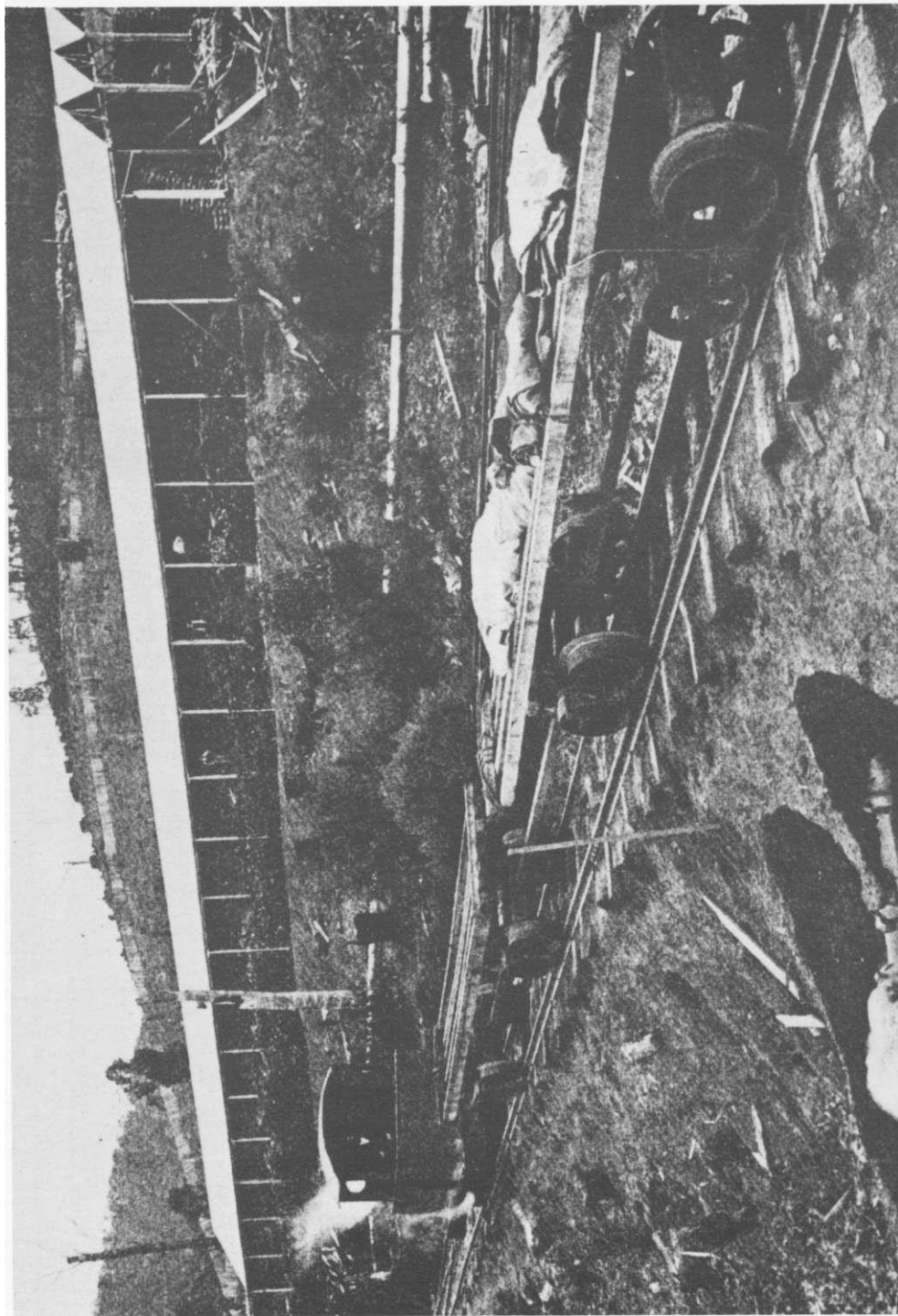
Acetic acid, in diluted form, was used for medicinal purposes and as a preservative for many kinds of foods; especially pickles and sauces. Acetone was largely used in the preparation of high grade varnishes. It was also used widely at the time in the production of celluloid "wearing apparel" such as collars, cuffs, etc. In addition, it was required in the manufacture of chloroform for anesthetic use.

The crude wood spirit left after the evaporation process was a

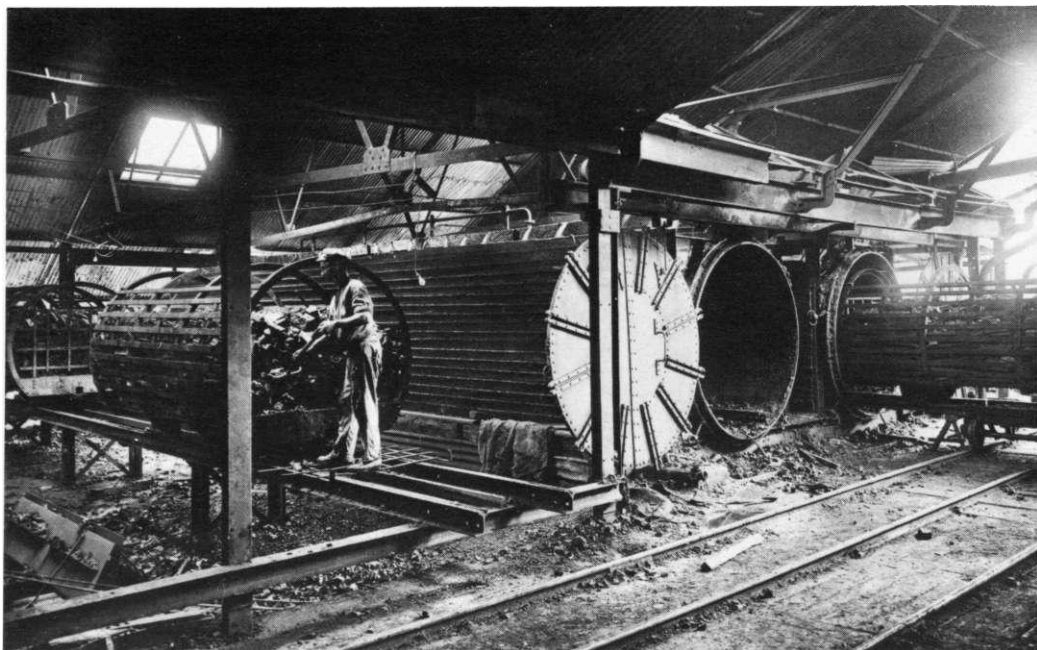
dirty yellow liquid consisting of large concentrations of acetone, methyl alcohol and allyl alcohol. It was purified by repeated distillations with various reagents until a pure methyl alcohol was obtained. Meanwhile, the acetone and allyl alcohol were removed by fractional distillation. Methyl alcohol was used extensively in Australia during the period in the manufacture of formalin. Methyl alcohol was heated, mixed with air, and passed through copper or platinum gauze heated red hot. This gauze caused the oxygen from the air to chemically combine with the methyl alcohol to become formalin. This substance, a solution of formaldehyde, was used extensively as a disinfectant and germicide. It was also used by farmers to cleanse seed potatoes and wheat from various diseases, then prevalent. It was further used in the manufacture of artificial silk and in preparing



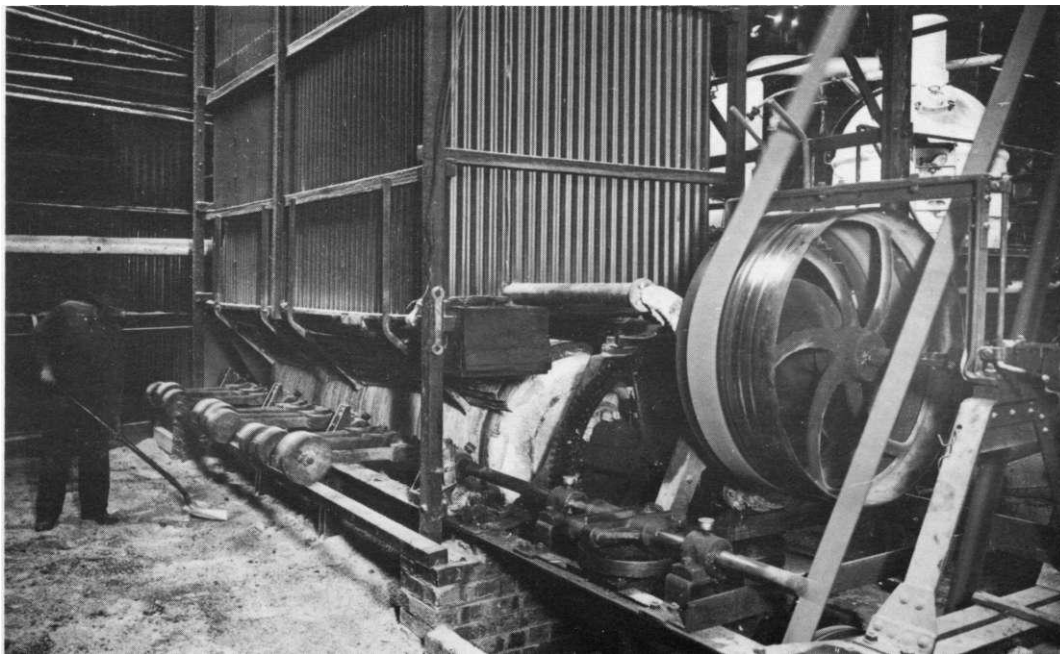
32. *Two 1500 gallon receiving vats for Pyroligneous acid. The first vat acts as a settler for crude creosote oils, which are drawn off from the bottom and filled into casks at once. A steam winch for charging and discharging retorts and other haulage, is seen in the foreground.



8. Wood storage and drying sheds with steam-hauled train in the foreground.



30. *Charcoal coolers, traverse track, emptying charcoal from retort cages to charcoal platform and bagging hoppers.



40. * Acetate of lime rotary filter drier.

certain leather products, in photography, and in manufacturing artificial ivory, tortise shell and horn.

Here, briefly, were the major products of the distillery:-

Pyroligneous Acid -the crude "liquor" (Wood Vinegar) obtained from the distillation. It was known in commerce as "Essence of Smoke" and used for curing bacon.

Acetate of Lime -recovered from the Pyroligneous "liquor", it was the raw material for Acetic Acid and Acetone.

Technical Acetic Acid - produced from Acetate of Lime. It was used in the manufacture of white-lead, deliming hides in tanning and making Amyl Acetate, etc.

Commercial Acetic Acid -used in pickle and sauce manufacture and in dyeing.

Glacial Acetic Acid (99%) - produced for laboratory use, and for preparing ceticnhydride used for the manufacture of Asprin and aeroplane "dope" for coating aeroplane fabrics.

Acetone -a product of the dry distillation of Acetate of Lime, and used as a solvent for gums, etc.; the manufacture of cordite (for explosives manufacture) and the preparation of celluloid items.

Acetone Oil - also refined as a solvent.

Butyl Aldehyde - had the same origin and uses as Acetone oil.

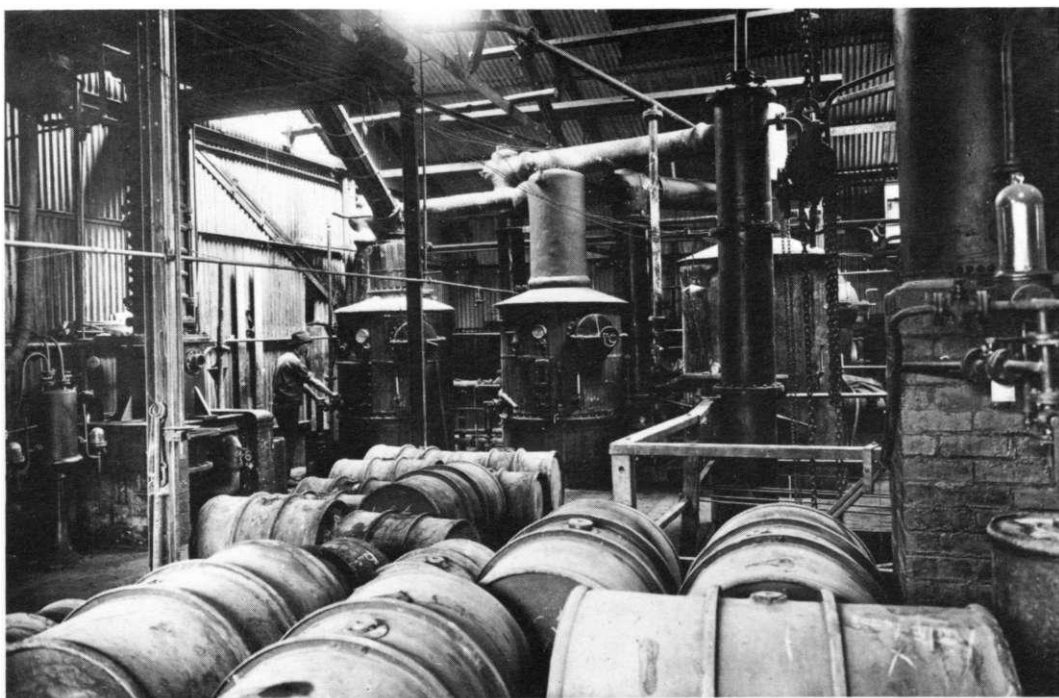
Denaturing Wood Naptha - the raw material for producing methylated spirits and power alcohol.

Pure Methyl Alcohol - prepared by refining Wood Naptha, principally to prepare "Sickle" brand Formalin, but also for toilet soap preparation.

Formalin - prevented Smut and Bunt



34. *Redistilling boilers for Pyroligneous Acid, just installed.



36. *Distilling and concentrating plant. Triple effect system for acetate of lime solutions, at the back, continuous still for crude wood spirit on the left, and a number of 120 gallon storage drums for acetone, butyl aldehyde, etc.

in wheat; also Scab in potatoes. Frequently used as a deodorant- a rather potent one!

Paraformaldehyde - a white precipitate from formalin used in throat tablets.

Wood Tar - recovered after initial distillation and valuable for its wood preservation properties.

Tar Oils & Tar Spirit - for prevention of foot rot in sheep.

Charcoal - the residue of distillation and used extensively for:-

1. Fuel.
2. Animal Feed.
3. Cool store wall insulation.
4. Filtering.

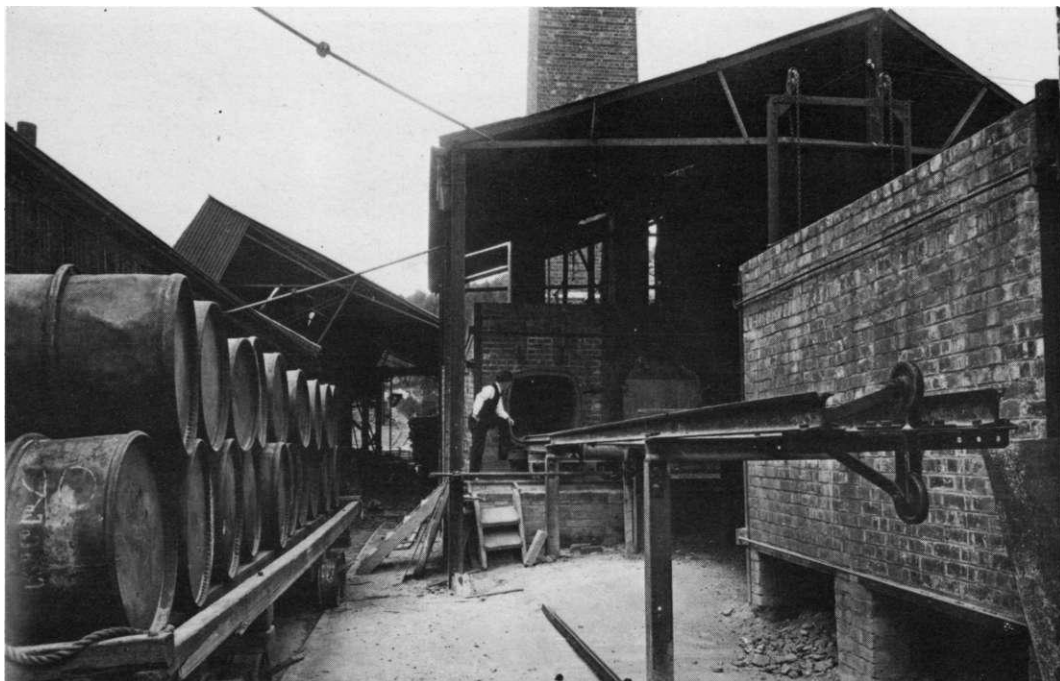
In connection with these rather extensive works, there was a large,

well equipped chemical laboratory. Two rooms were fitted out with the "latest" equipment and all products carefully tested.

TIMBER SEASONING.

Naturally, much of the timber cut around Britannia Creek was suitable for sound timber purposes. Thus, in addition to the extensive distillery operation already described Cuming, Smith and Yelland also operated an extensive timber seasoning concern.

As natural seasoning made for a greater wastage, artificial seasoning was used by the Britannia Creek operation. Timber cut at the mills was stored in the open for several weeks before being kiln dried at the distilling plant.



42. *Retorts for the manufacture of Acetone from acetate of lime. A truck load of empty drums from C.S.R.Co. for Denaturing Spirit, in foreground.

Partly dried wood was stacked on kiln trucks with cross sticks between each row of boards, etc. to allow a free flow of air. These kiln trucks were then horse-hauled to the traverser and loaded into the drying kilns. Each kiln took one loaded truck bearing several thousand feet of sawn timber. It is not known by the writer just how large each of these kilns and kiln trucks were, but to judge from the size of the traverser the trucks were not likely to have been more than 15ft long.

As cold air was drawn into the kiln at its base, it passed over a number of steam heated pipes. Warm air, circulated through the chambers carried away the moisture. The humidity of the kiln, the temperature of the air and rate of circulation could all be controlled to minimize the wood shrinkage.

Timber usually took seven to ten days to dry thoroughly. With seasoning complete, the steam winch drew the truck out of the kiln onto the traverser from where it made its way eventually to Britannia siding.

PLANT CLOSURE.

Distillation at the Britannia Creek plant continued through to 1924, when on the 17th of August the plant shut down. This closure was chiefly due to two changes in primary industry; the declining use of charcoal and new, cheaper chemical production processes other than wood distillation. The plant had used much waste timber to produce its chemicals, but even with this economy it was unable to compete with changing technology that could produce by different methods the same chemicals at a

fraction of the cost.

Charcoal as a fuel was being quickly replaced by cheaper petroleum products and higher quality coals. In any case, the amount of timber required by the distillation process, was massive when compared with the results. It was estimated that about 4000 cords of wood, when distilled, yielded 12000 gallons of methanol, 36 -40 tons of creosote, 17 tons of acetone, 280 tons of grey acetate and 150 - 160 tons of tar. At its peak, the plant could earn around 20000 pounds in revenue annually. Despite its short life, Britannia Creek remains significant in that it was the only wood distillation plant, in Australia, to operate on a commercial basis.

THE YELLAND INTERESTS.

After the plant closed down in 1924, Frederick and Victor Yelland, trading as Yelland Bros. Pty. Ltd., Britannia Sawmills, continued to mill the area and rail sawn timber out to Britannia siding. At the time

of the departure of Cuming, Smith and Co. from Britannia Creek only the No.3 and No.4 mills were operating. No.2 mill had closed around 1920, and the No.1 mill possibly earlier.

The sites of the original No.1 and No.2 mills are uncertain, however, in 1926, the Yellands erected a new mill midway between the old distillation works and the No.3 mill. This new mill was let to Messers Drain and Morris, who were logging on private property to the south. Apparently, Drain and Morris were granted running rights on the tramway providing their own motive power to and from Britannia siding. They continued at this location until about 1930 when the mill closed only to reopen in 1932 as Yelland Bros. No.2. Previously, in 1927, the Yellands established a small case mill and planing shed about three-quarters of a mile west of that operated by Drain. The purpose of the mill, which was known as the No.1 case mill, was to cut the timber killed in the 1926 fires.



13. The distillation plant with locomotive "Westward Ho" stored, out of service. 1917.

Photo; LRRSA Archives.



10. Yellands No.2. mill looking east. 1917.

Photo; LRRSA Archives.

Log tramways were extended from the mills to both north and south of the mainline. The routes taken by these tramways in Cuming, Smith and Co's time are not known, however, by the mid 1920's most of the mills were served by inclined tramways with graded lines running off these inclines. The No.3 mill was notable in that in 1931, an incline was laid to the south of the mill to connect with the network of log tramways which had by this time been abandoned by the firm of Taylor and Sons. The Yelland brothers completed logging out Taylors old area using Taylors old tramways.

In 1934 a log tramway was laid to extract the remaining timber in Ewart and Ellis' area (formerly Hermans area) to the north. The line left the main tramway about half a mile (800m) east of No.2 mill and headed north for one and a half miles (2.4 Km) to the watershed separating Four Mile Creek and Britannia Creek. A winch was

established at the terminus of the tramway and logs hauled out from near the site of Ewart and Ellis's old mill.

The No.1 case mill and No.4 mill closed down in late 1932 while No.2 survived until the end of 1935. The last remaining mill, No.3, closed in May, 1936. The machinery from Yelland Bros. No.3 was dismantled immediately after closure and hauled out over the tramway apparently to be utilized in the firms' newly opened Matlock area. The tramway was last used at the end of May, 1936. Dismantling of the line commenced immediately and was completed before the end of the year. Bushfires ravaged the area in 1926 completely destroying the works buildings and seriously damaging the Yelland enterprises. However, the tramway was repaired and continued to operate to the end of milling in the area.

OTHER CUMING, SMITH INTERESTS.

Although all distillation at the Britannia Creek plant ceased after 1924, Cuming, Smith were still involved in the timber industry of the Upper Yarra area up to 1932. In 1917, the Mississippi Sawmilling Company was acquired and in 1919, J.M.Grants seasoning works at East Warburton came under their control. They took over Enterprise Sawmills in 1925, and continued to operate all of these concerns until around 1933. During 1928, Cuming, Smith & Co. considered the purchase of the Loch Valley Tramway, the Mount Horsfall Tramway, and many other existing tramlines. However, in 1929 the company decided to limit further investment to chemical and fertilizer interests. Today Cuming, Smith, Smith remains in existence as an investment company, being a major shareholder in ICI Australia Ltd.

CONCLUSION.

In its heyday, Britannia siding was quite a sight. In addition to the enormous stacks of seasoned timber, the wide variety of chemicals produced at the distillation plant required rail transport. Charcoal was bagged at the plant and transported in the form. Many of the chemical products were shipped in earthenware or glass bottles (carboys) enclosed in wicker baskets. Acetone, Butyl Aldehyde, and some of the other chemicals were shipped in 120 gallon drums. Quite a variety in addition to the extensive quantities being handled.

Today, very little remains to be seen of the operation. The concrete base of the main plant still exists and occasional tramway formations can be picked out beyond the site. Three of the plant residences remain at the site, two



11. Temporary tramway between Yellands' No.2. mill and No.1. winch. 1917.

Photo; LRRSA Archives.

of them in use as accomodation for Girl Guides as part of a Guide Camp. The actual plant foundations are partially occupied by a sawmill, functioning in 1980. But with these exceptions there is nothing to show for Australia's only commercial wood distillation plant and its tramways.

ACKNOWLEDGEMENTS.

My thanks to Geoff Maynard for the use of his article on the tramway (published in "Light Railways", Spring 1968, No.23.).

Thanks also for the material supplied by Messers Ted Stuckey and Mike McCarty. Other sources were Cumings, Smith files and publications (including "Our Forest Industries".).



4. An overall view of the plant at Britannia creek, c.1923.