

WATER, WIND & WOOD

England is often credited – or cursed – for the first Industrial Revolution in the 1700s. Yet over 100 years earlier a 'poor farmer's' invention began a boatbuilding boom in the Netherlands. Boatbuilder, teacher and qualified miller Bert van Baar shares the history of the Dutch windmill-powered sawmills.



According to the dictionary, a saw is 'a flat steel cutting blade with sharp teeth'. Research has shown that the oldest known tool for sawing tree trunks and beams into the slender lengths needed for the construction of wooden buildings and bridges, ships and boats, was probably the frame saw: a wooden frame into which the saw blade was clamped.

The largest saw was the pit saw, named after the place it was used: a pit dug especially for the purpose. Six feet (2m) or even deeper – the length of the saw – the sawpit required two sawyers, each alternately pushing and pulling, one standing on a platform across the pit, the other – the 'underdog' – standing in the pit beneath the log being laboriously sawn as sawdust and sweat rained down on him.

It was estimated that a good pair of sawyers would take around two working days to convert a tree trunk into useable boards, depending on how thick the boards needed to be. But that was before the first sawmill was invented.

A green industrial revolution

Although Cornelis Corneliszoon of Uitgeest described himself as a 'poor farmer with wife and children' when he applied in 1593 for a patent for a wind powered sawmill, in fact he

was a skilled millwright, inventing and building windmills of different types – to pump water, to grind corn for flour, pigments for paint and linseed to produce oil. His sawmill was similar in design to a windmill which used the wind to turn a paddle wheel to create water flow for drainage but instead of a wheel, he fitted a massive axle which extended into a separate adjacent building. A modern car engine has a crankshaft to convert up-and-down piston action into



Top: Old Dutch buildings used timber imported from Scandinavia and sawn from logs at windmill-powered sawmills, like the mill seen right.

Above: Doing it the old – and hard – way: sawing timber in a sawpit.

Facing: Contemporary images of Corneliszoon and his wind sawmill

rotary motion. Cornelis did the opposite, adding cranks to his wind-rotated axle to create a crankshaft to power the up-and-down movement of two or three enormous frames of saw blades. The blades were spaced the required board-widths

apart to cut several boards simultaneously in a single pass of the log through the saw.

By the early 1600s, instead of hand sawyers sawing one log into board in two days, wind-powered sawmills, copies and derivations of the Corneliszoon invention, were being built across the Netherlands which could convert to board 60 logs in less than a week. It is estimated that the production of timber for shore structures, ships and boats rose by 3000%, with zero fuel cost and led to the Dutch 'Golden Age'.

How a wind sawmill works

Let me introduce you to a sawmill called *Het Jonge Schaap* – The Young Sheep – on the river Zaan near Zaandam, the city where Tsar Peter the Great learned 'the ropes' of boatbuilding in 1697. The Young Sheep is a *boven-kruier*, a top-turning sawmill which means that the hood with the shaft and the rotating *wieken* – the 'propeller' blades attached to it – can be turned into the wind by a capstan and chain located on the *stelling* – the balcony – halfway up the mill's body.

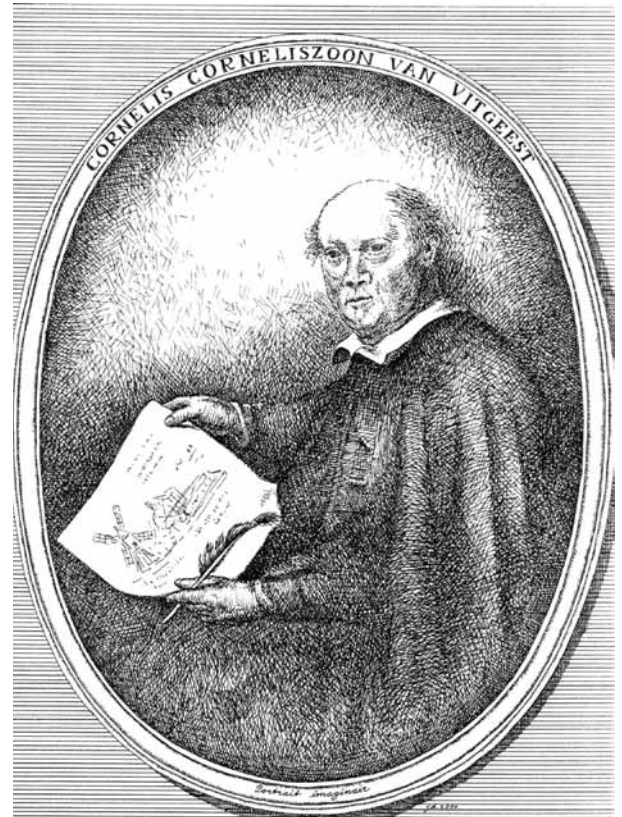
With this kind of mill, only the hood is turned to the wind, the rest is fixed in the ground. The windmill's blades are covered with sails to catch more wind or reefed when there is too much of it and like propeller blades, they are curved for the most efficient aerodynamic yield.

The hood is turned so that the heavy wooden – later cast iron – axle on which the *wieken* are mounted is directly head on to the wind. On the axle, smaller wooden or cast iron cog and worm wheels transfer the rotation to the crankshaft, what Cornelis called his *creckwerck*. At the Young Sheep, the crankshaft drives three sawframes up and down like pistons. Each sawframe can hold a number of sawblades which are adjustably spaced for plank thickness. These saw frames, the most important and visually striking parts of a sawmill, glide between large fixed wooden uprights which keep them in place while sawing. Beeswax is used as a lubricant.

The saw carriage

Almost all the timber which built the Netherlands' Golden Age – the fine merchants' houses of the cities; the fine vessels of the Dutch East India Company – had to be imported from Scandinavia. Towed to the sawmill in rafts along the canals, before it could be sawn each log needed to be seasoned from 1 to 5 years in the millpond to prevent warping and splitting. It was then dragged up the ramp by wind power where the bark was removed using long chisels, before being pinch-barred on to a saw carriage.

The saw carriage transports the log through the sawframe and is not much more than a rather elongated frame on wheels. It consists mainly of two parallel beams with rows of poles along its entire length to which the log is secured. In each of the two 'girders' of the saw carriage, a full-length rabbet is cut on the underside which positions the carriage over lines of nuts on the sawmill floor which act like a railway track, so the carriage





can only move forwards or backwards. For straight unwarped planks, any sideways movement is unwanted so this is a very important part of the mill.

The saw carriage is moved forward through the sawframe with each downward stroke of the sawblades by an ingenious hauling mechanism called the winder. It looks like a horizontal capstan and works like the escapement on a clock but since a tree trunk can weigh up to 2 tons (2000kg), depending on the timber species, the winder is very massively built. It is turned bit by bit by a scribble wheel which is pushed by a wooden or iron rod, fixed on the sawframe. In this way the carriage hauler is driven by the movement of the saw frame. Every upward motion of the saw frame causes a small forward movement of the carriage, so the log is fed to the saws a few millimetres at a time....

Like a normal handsaw, the teeth of the saw blades must reach a certain speed to rip the wood. Sawing only takes place when the saw frame moves downwards. The downward movement starts from a standstill, increases in speed and then ends at a standstill to immediately continue in an upward motion. This means that the teeth of the saw only 'bite' into the wood when there is sufficient downward speed. When the downward speed decreases at the end of the stroke, the saw frame is pushed backwards so the teeth of the blade and the sawdust can be released from the log.





Facing page top: *The fully restored Young Sheep today. Below: The sawmill has adjustable sawframes to cut planks with different thicknesses simultaneously. Above: On its saw carriage, the log inches through the saws at varying speeds dictated by the wind.*

Then and now

At the height of the sawmill industry, there were more than 200 sawmills in the Zaanstreek alone. In favourable conditions and with hard work, around 20 trunks could be sawn each day by a crew of 5 men, who often worked at the mill during daylight hours from early morning until late at night.

Today, there are 15 wind-powered sawmills in the Netherlands. They work almost in the same way; some even combine sawing wood with grinding pigment-powder or pressing oil from natural resources for the production of paint. Apart from the miller, the current workforce consists mainly of

volunteers. Costs for maintenance of the mill are covered by sawing wood and selling it.

Learning the trade to become a miller is still possible; in fact, we strongly encourage it. Many volunteers who have completed the free two-year training to become millers work at sawmills around Holland. Most sawmills are an official training location and most millers are qualified to train future millers.

With our thanks for the illustrations to Pieter Tolk of the Stichting Cornelis Corneliszoon van Uitgeest. For more information – in English! – see: www.houtzaagmolen-uitgeest.nl/sites/default/files/cornelis_cornelisoon_van_uitgeest_foundation_v2.pdf

