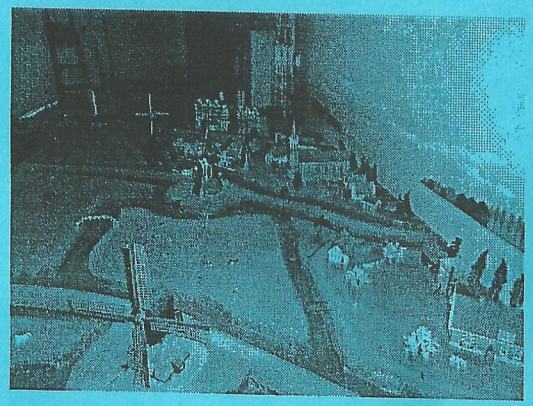
The Sloten windmill

The Sloten windmill

Let's get started: the ground floor

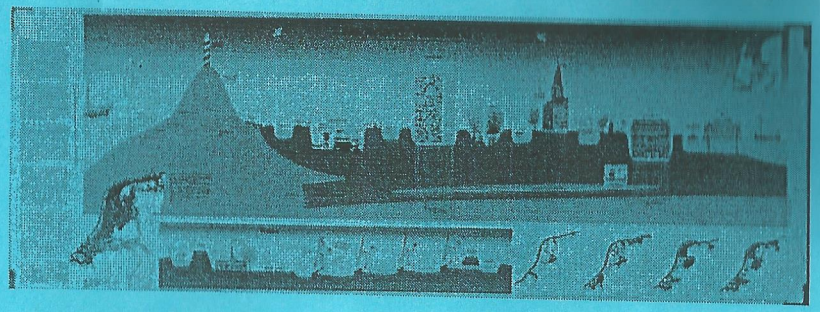
There are approximately 1170 windmills still left standing here in the Netherlands, and this is one of them. In the past, there were more than 10,000! This is a "polder" windmill, designed to pump water up out of the polder. Other windmills were built to saw wood, or to press oil from seed, or to grind corn, etc etc... Each windmill had only one function.

As you leave the shop to enter the windmill, turn left. This large model shows the rural area around Sloten as it looked about 200 years ago. On the diagram above the model you can see the problem faced by this area (and most of the western half of the Netherlands): the land lies below sea level. This means that all the rainwater that falls here has to be pumped up to the sea – it cannot flow there by gravity.



In this part of Amsterdam the water level is more than 2 meters below sea level. In some parts of Amsterdam it is around -5 meters and at Schiphol airport it even reaches -6 meters!

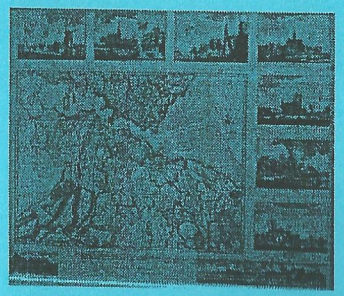
The windmill's water-pumping function is very important in this area. This windmill pumps the rainwater up into the Ring Canal, which in turn brings the water to the North Sea Canal. From there the rainwater is finally released into the sea.



In the period shown on the model Amsterdam was still some distance away f the village and the wind was easily able to reach the windmills. The houses you here are scale models of those you can see for yourself in the 1000 year-old vil of Sloten, just across the road from here.

The two hollow post windmills ("*wipwatermolens,*",recognizable by their pyra base) on the model have since been replaced by electric pumps. Th "wipmolens" used a waterwheel to raise the water up to the next level. They c do this at a rate of 40.000 litres per minute. The Archimedes screw at the Sl Windmill can pump at a rate of 60.000 litres per minute.

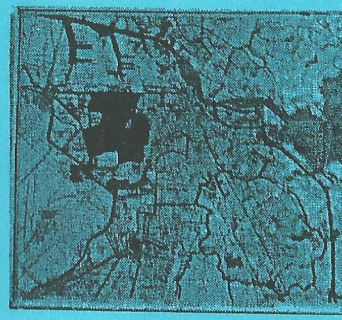
In the 20th century Amsterdam underwent a massive expansion and the old villag of Sloten became part of Amsterdam. More and more houses were built and the blocked the wind. So when this windmill was reconstructed here in 1991, two ex storeys were built to raise the windmill high enough for the sails to catch the wir The platform, or *stage*, was built at what used to be ground level, to give the mi access to the sails and the capstan wheel ("*kruiwiel*"). The name for an octagon windmill with a platform like this is a *smock mill with a stage* ("*achtkante stellingmolen*").

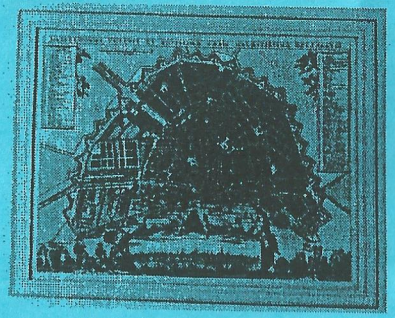


On the map made in 1749 (to the left of the s door opposite the model) you can clearly see th took a lot of windmills to control the water level in western part. In the area of Sloten alone you four windmills pictured.

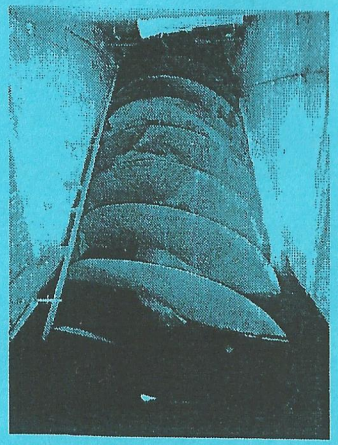
You can also see how the rainwater was drained both the Zuider Zee and the North Sea via the Canal and other water routes.

To the left of this map is a modern map of Amsterdam, showing (in blue) the area which the Sloten windmill helps to drain. The heavy black lines which you see are dykes, and in each of these blocks you see the water level to be maintained. For example, in the blue area you see -2.10 m. In the bottom left corner you will see Schiphol airport, where the water levels are a lot lower!



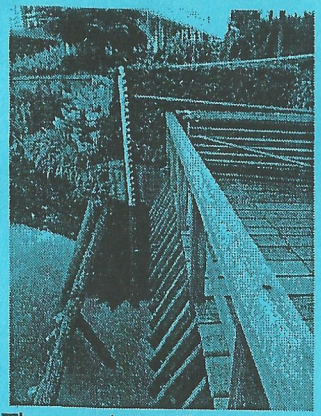


Further to the left, on the old map Amsterdam, you can see how many windm the city used to have. On the city walls a you can count more than twenty windm These stood high above the houses to catch wind. Not all the windmills were for pum water. Many were for grinding corn into fl sawing wood (sawmills) or for hulling barle produce groats – a staple food in past centuri



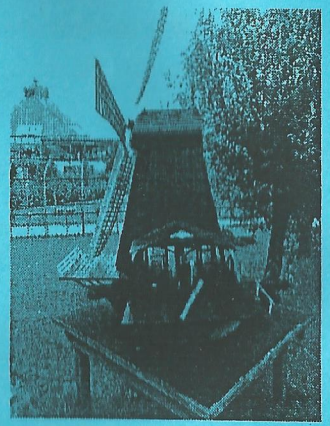
Turn back to the small door on your right . Here you can go **outside** and use the wooden steps to your left – mind your step! Underneath the windmill we can take a look at the Archimedes screw. With average wind speeds the windmill can pump the water 1.5 metres higher. Each compartment of the windmill can hold 1 m^3 of water. At top speed, this Archimedes screw can pump 60,000 litres per minute. Since 1991, we have an Archimedes screw made of metal.

You can see one of the old wooden Archimedes screws at the front of the museum. In freezing winters the ice could cause a lot of damage and these wooden screws frequently had to be replaced.



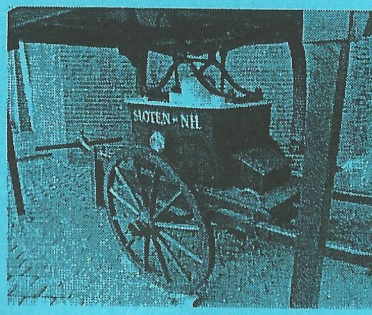
On the measuring post in the water you can check today's water level. It should be -2.10 m. At the top you see "NAP" – this means Average Sea Level. Here you can see that the water is much lower than on the other side of the windmill (where you entered via the shop). In the water channel at the top of the Archimedes screw there is a hinged flap that only opens in one direction (the *automatic sluice door*). This prevents the water that has been pumped up to the next level from flowing back.

The wooden grille in the water on this side is to prevent larger items (e.g. tree branches or floating rubbish) from flowing through and blocking the Archimedes screw. Turn around and go through the door behind you to see the screw.



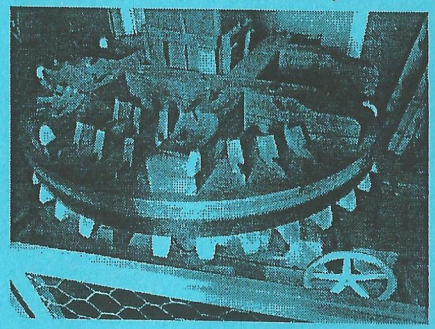
On your way back to the steps you will pass a scale model of a "paltrok" mill – named after the shape of a wide "palatinate skirt" and always used as a sawmill. This whole windmill has to be turned to face the wind. Using the capstan wheel and winding chain anchored to poles fixed in the ground, the miller can turn the whole mill on its base. Wind power is used to first raise the logs from the water and lay them on a carrier. The model shows how the frames on the sawing floor move as the sails turn. These frames contained blades for sawing the planks.

There are only 5 paltrok mills left in the Netherlands. One of these is in Amsterdam.



At the top of the steps you pass an old fire engine. This invention by Jan van der Heyden in 1667 helped a lot with putting out fires in Amsterdam's wooden houses. This example from the village of Sloten dates from 1880.

Go back into the windmill and walk back past the model and the door to the shop. Through the glass doors on your left you can see the large cog-wheel (*crown wheel*) attached to the bottom of the central axle (the *upright shaft*). The upright shaft is 18 meters long and made from 2 cm thick cast iron. The crown wheel has two rows of teeth: the la outer row for the heavy work and the inne smaller row for lighter work.

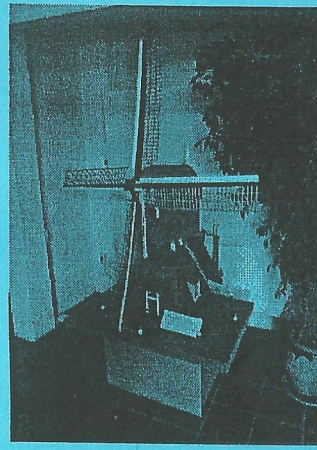


The crown wheel can be disengaged from bevel wheel at the top of the Archime screw. In this case the sails can turn with any water being pumped.

The teeth of the gear wheels are kept in good condition by rubbing beeswax the wood.

If you look outside through the glass doors behind you, you will see another measuring post in the water. The water level here is 1.5 metres higher than at t bottom of the Archimedes screw – only 60 cm below sea level.

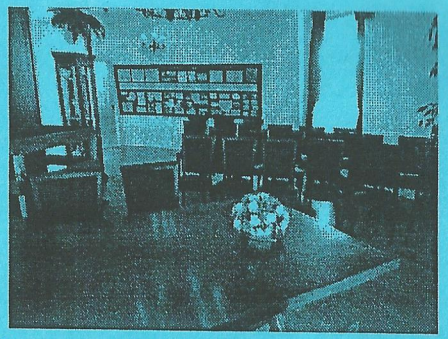
To the left of the doors to the crown wheel is a large model of a hollow post windmill. We saw outside how the paltrok windmill turned from the base. In the hollow post windmill, only the house and sails turn, above the pyramid base. The Sloten Windmill is different again: only the cap and sails of the windmill turn. It is very important that the sails face the wind, that's why they all share this ability for the sails to be turned.



In this part of the windmill we also see the photographs of the grand reopening of the mill in 1991 and a large photo showing ground-sail mills ("grondzeilers") – where the wind access is good enough for the mills to stand at ground level.

You can take the stairs or the lift to the next level.

Up to the Wedding Room



You are still in the modern part of the building, added in 1991 to enable the wind to reach the sails. This room is used for official wedding ceremonies. Each year about 60 happy couples tie the knot in this very unusual wedding location. On the left-hand wall are photographs and maps which tell the story of the old village of Sloten. On the opposite wall is a similar display about the development of the "garden city" of Osdorp.

The village of Sloten is about 1000 years old, and well worth a visit. On the village square the water pump, once an important source of drinking water for the villagers, still works. You can also see the original fire alarm and the smallest police station in the Netherlands. A few houses further, in the gap next to Sloterweg 1208, is one of the four remaining "ban poles" built to show banished criminals the outer limits of Amsterdam's jurisdiction. If they chose to pass the pole they risked imprisonment or even execution.

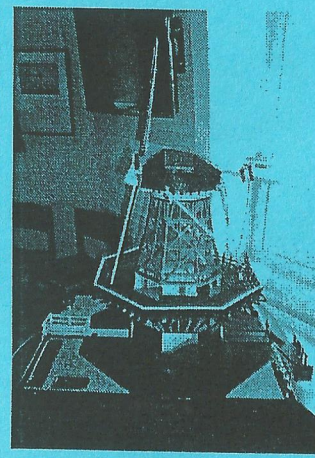
The video presentation on this floor shows the miller at work: turning the cap of the mill so that the sails face into the wind, attaching and removing the canvas sail covers, lubricating the upper axle, treating the gear teeth with beeswax etc.

Going up again: the stage

Leaving behind the new structure added in 1991, you can take the lift or the stairs to the next level. When the mill was still in its original position, this was the ground floor. In those days, the miller could just walk outside to work on the sails or to put the brake on, or to turn the cap of the mill. However, it was (and still is) **very important to use the correct door**: a windmill always has 2 doors – because the sails might be passing close to one of the doors and that would be very dangerous! The sails can reach speeds of up to 100 km per hour (over 70 mph).

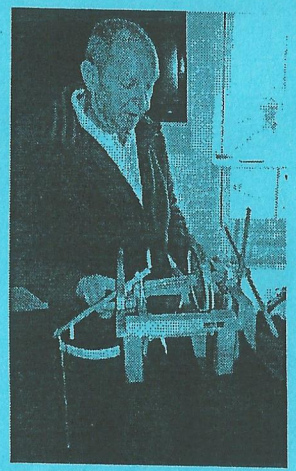
Before you go outside, take a look around at the photos and models on display. The series of photographs on the wall starts with the mill in its original position (on the Eastern Ring Dyke in Watergraafsmeer in Amsterdam East). The remaining photographs show its reconstruction here.

The lower part of the building, made of bricks, is new. The octagonal wooden structure from the "ground-sail" drainage windmill originally built in 1847 was placed on top of this. This drainage mill was used to pump water out of the Watergraafsmeer polder until 1878, when this task was taken over by a steam pump. The cap and the stocks (the stocks are the two cast iron shafts which support the four sails) were removed and the truncated body of the windmill became the home of the steam pump operator.



There is a scale model of the Sloten windmill on this floor. Looking at this, you can see the details of how things work.
You can also see that the cap of the windmill is connected to the large capstan wheel on the stage. If you gently turn the cap of the mill, the capstan wheel on one side and the sails opposite will turn at the same time. You can also see how the central axle, or upright shaft, runs all the way from the cap of the windmill t the crown wheel, 18 meters lower down.

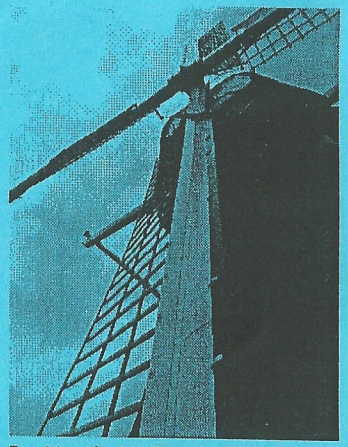
Two sails are attached to each of the two cast iron stocks, which are connecte the centre of the cross to a cast iron wind shaft. The wind shaft is 21 metres ab the ground and is supported by a piece of granite rock. This part of the wind sl is lubricated daily with lard (pork fat). Otherwise the friction of the iron sl rotating on the stone would present a real risk of fire. This is also one of reasons the sails cannot be allowed to turn too fast. Another reason is that ther a danger that the brake would no longer function safely.
The wind shaft is not quite horizontal because the sails should not turn i completely vertical plane. They are inclined slightly, 18°, because everything is k in its place this way. The large gear wheel around the wind shaft is called



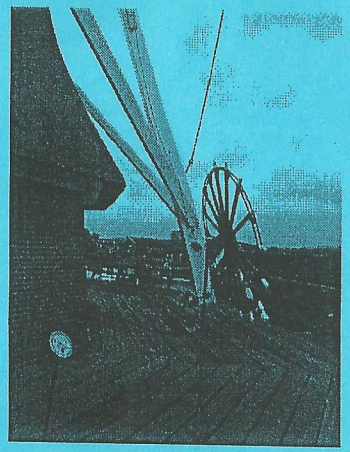
brake wheel. As it turns, it drives the gear wheel arou the top of the upright shaft (this one is called wallower). If the sails turn faster, the central axle the Archimedes screw (if attached) also turn faster.

There should also be a small wooden model of just the cap (this is the model in the millers hands in this pictur It shows how the brake works. The brake wheel is enclosed by an almost complete circle of brake blocks. These are operated from the stage: the miller pulls the rope which is attached to the brake lever, which causes the brake blocks to grip the brake wheel. This stops th sails from turning. The miller pulls on the same rope t release the brake, allowing the sails to turn again.

You can take a look outside now, on the stage.



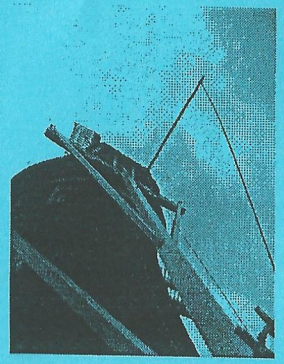
You can see which door to use today by looking at the floor: **use the door with a doormat in front of it** (the other door is locked). **Very important safety information:** children under 12 years old may only go outside with an accompanying adult. Very young children should be held by the hand. Do not pull on any ropes, do not remove any safety barriers, and do not climb on anything.
From the stage you have a good view of the sails. You see the solid part of the sails is set at an angle to the open wooden grid. Often this catches enough wind to turn the sails. If there is not enough wind, the miller can cover the wooden grid with canvas to make the sails turn faster.
In North Holland, the wind and the rain arrive together from the North Sea. So if it's raining, it's windy enough to turn the pump!
From here you can also see that the water in the Ring Canal is higher than the water at the back of the mill. Whenever you see a road with different levels of water on each side, then you know you are also looking at (or standing on!) a dyke.



The capstan wheel is connected to the cap. The main connecting beam is called the tail pole. By turning the capstan wheel, the miller can reposition the cap of the mill so that the sails face the wind head-on.
The photo (left) shows how the capstan wheel is attached to the stage by a chain, anchored on both sides of the tail. There are holes available all around the windmill for the anchors. To turn the cap of the mill, the miller repositions one of the anchors then turns the capstan wheel with his hands - or he can step on the wheel and use his feet.

Of course, before repositioning the sails, the miller puts the brake on. He pulls on the rope near the capstan wheel to operate the brake lever (see photo).

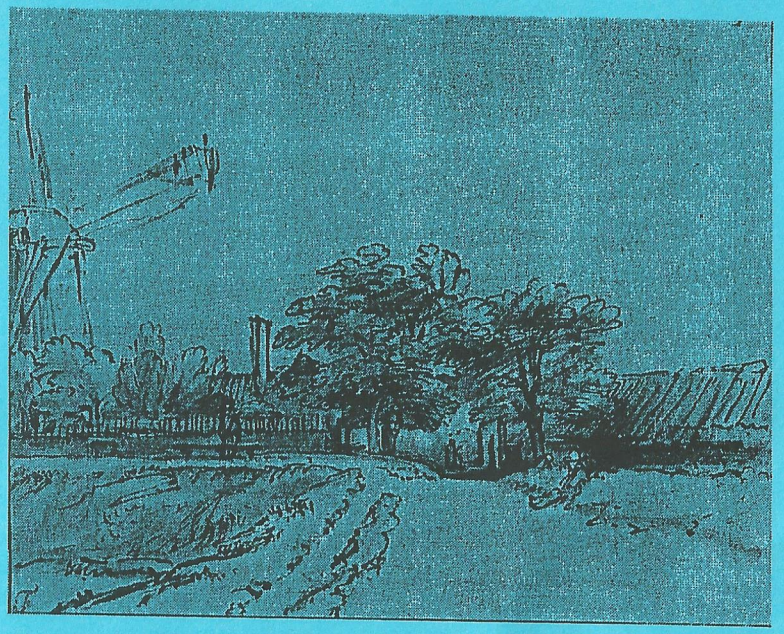
We can also see that the mill is thatched with reed. This is waterproof and lightweight – the weight of a building is important because of the clay soil in this area.



Use the same door to re-enter the windmill. To go up to the next level (*loft*) we use the steep wooden staircase behind the door (or: next to the door opposite!)

Next level:
Rembrandt in the attic.

You can really see we are now in the old part of the windmill. The heavy wooden beams date from 1847.



This used to be the bedroom, where the miller's whole family slept. Sometimes the miller needed to pump day and night, but letting the sails turn unattended is a bit risky. If the wind gets too strong, the miller has to make the sails turn more slowly or stop them completely – otherwise they might cause a fire in the cap of the windmill.
In order to sleep at night and still keep the mill under control, the miller could use this trick:

Hang a metal ring on a piece of string, then attach the string to the central axle. Attach a bigger piece of metal, e.g. a tin can or a bell, to the wooden barrier around the central axle.

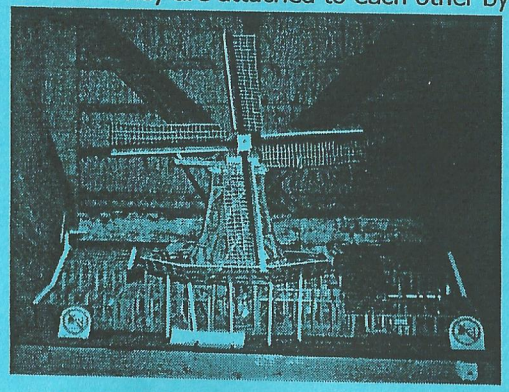
The stronger the wind blows, the faster the sails turn the central axle. As the central axle turns faster and faster, the metal ring on the string spins out higher and higher, until eventually it hits the bigger piece of metal every time it passes it.

Using this simple technology the miller could sleep peacefully, secure in the knowledge that if he needed to take action to stop the sails, the windmill itself would wake him up.

Higher still:
The miller's work and storage area

Mind your head on the way to the next steep staircase!

Here the light can get in again, so we can admire the big, heavy, 170-year-old beams. They are attached to each other by a wooden three-pin system. The three wooden pegs allow for some movement in the beams, which is important because the movement of the sails and the central axle puts some strain on the wooden construction.

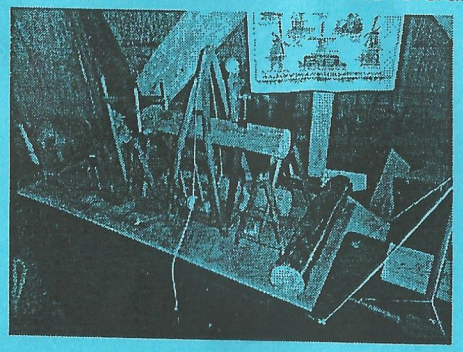


Every level of the windmill is called a loft, and this level is actually used to store old household objects, just like the loft of a house.

Here we have a scale model of a smock mill with a stage. This one functions as a paint mill. The millstones are used to crush coloured stone, wood or other natural resources, in order to create pigment. The millstones are perpendicular to each other, unlike in a corn mill, where they are parallel.

The stamping action you see on the left is used to crush the harder types of stone.

You can also see a model of the forerunner to the paltrock sawmill. The heavy logs were lifted out of the water with a pully system and placed on a trestle. They were then sawn by hand into planks.

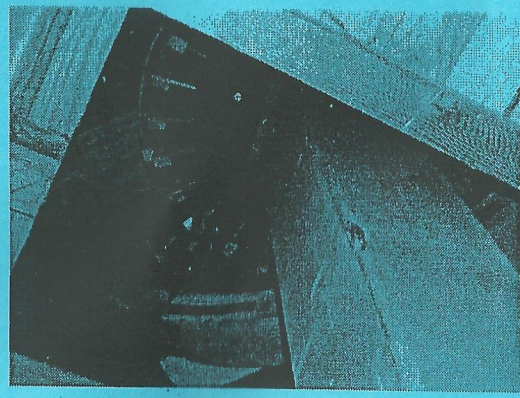


We are not allowed to go any higher than this level. Above us we see the cap. From here we have a good view of the cap. From below, we have a good view of the gears.

The Cap

Looking up from below, we see the upright shaft and, attached to that, the wallower. The cogs (wooden teeth) of the wallower, which are coated in beeswax, connect with the teeth of the brake wheel. The brake wheel is connected to the sails by means of a cast-iron axle, the windshaft.

You can see the wooden brake blocks around the largest gear wheel, the brake wheel. By tightening the brake blocks around the brake wheel the miller stops the sails from turning. This also stops the upright shaft from turning.

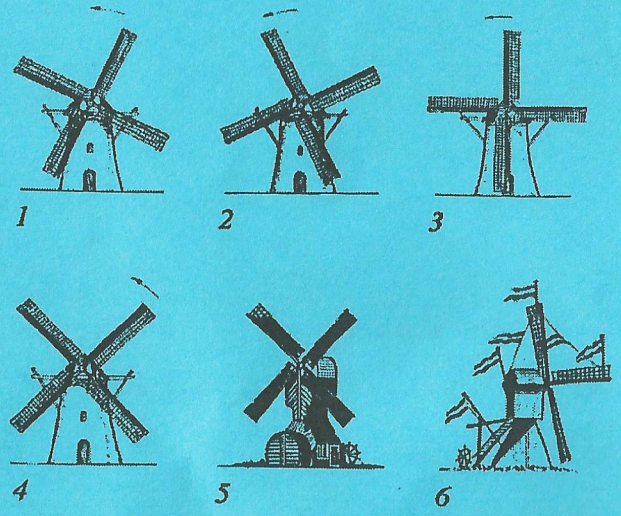


The cap and the sails have a combined weight of 12 tonnes. That all has to be able to turn through 360°. To help with this, the cap rests on 40 small metal wheels, on a rail. These are barely visible from here, but there is a diagram on the wall, by the window nearest the stairs.

Windmill communication

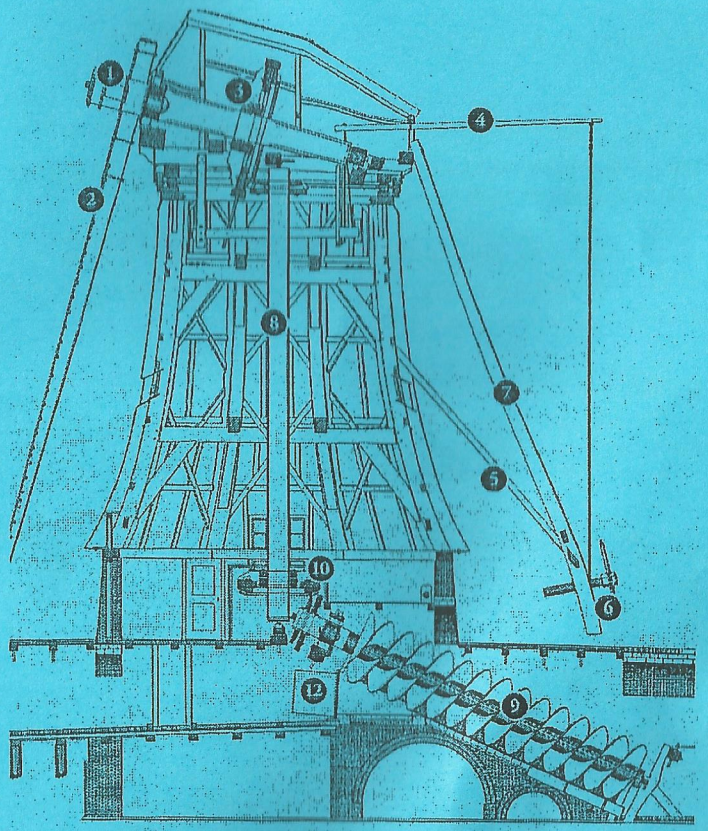
In many areas the position of the sails (when the brake is on) has a particular meaning. This can vary from region to region. Here are some examples of windmill "sign language" used in the Netherlands.

NB: in the Netherlands, the sails of a windmill always turn anti-clockwise – seen from 'the front" (where you can see the *whole* cross shape)



1. The top sail has not yet arrived at the highest point. It is not quite vertical. This symbolises arrival, and joy. It is used to announce a birth or a marriage. For a birth, it may be shown for a week; for a marriage, just a day. In this position, the sails can also be decorated with flags or other decorations, such as "Zaanse finery "(6).
2. The top sail has passed the highest point. This signifies departure, and sadness. It is often used when someone has died, in the days leading up to the funeral.
3. If the topmost sail is vertical, this signifies a brief stop. The mill will soon be working again.
4. The diagonal cross spells out that the mill is closed for business: perhaps there is a maintenance problem, or the miller knows that the mill will not be working for several days.
   This was especially important for cornmills in the countryside – the farmers could see from afar that there was no point bringing their corn to the mill that day. In the days when the two sail supports (the stocks) were made of wood, this position also helped to prevent distortion.

Summary and cross-section



1. The wind shaft: (pronunciation tip: *wind* like in "windmill")
This axle is situated 21 meters from the ground. It connects the sails to the meters in diameter brake wheel.

2. The stocks:
Every windmill has two stocks. Each stock is 26.4 metres long. Two sails are attached to each cast-iron stock.

3. The brake wheel:
The 3 meters in diameter brake wheel drives a smaller wheel, the wallower, which turns the upright shaft (the central axle). The brake wheel is surrounded by the brake blocks.

4. The brake lever:
Using the rope attached to the brake lever, the miller operates the brake from the stage.

5. The long and short braces:
Together with the tie beams and the tail beam (7), these allow the miller to turn the cap.

6. The capstan wheel:
This is the large wheel attached to the tail beam. A chain runs around its axle. This chain has an anchor at each end, which allows the capstan wheel to be fixed in position. The miller hooks each anchor into one of the many holes cut into the stage all around the mill. By moving the anchors and turning the capstan wheel, the miler pulls the cap into the required position. He stops turning the cap when the sails face square onto the wind.

7. The tail beam:
The tail beam, the long brace and the short brace are attached to the cap. They allow the miller to turn the cap into the wind. The cap turns on a metal rail with 40 metal wheels.

8. The upright shaft:

This central axle is 18 meters long and runs all the way to the Archimedes screw underneath the windmill. The gear wheel attached to the top of the upright shaft is called the wallower and the gear wheel attached to the bottom of the upright shaft is called the crown wheel (10).

9. The Archimedes screw:
The crown wheel (10) turns the bevel wheel, which is attached to the Archimedes screw. So when the upright shaft (8) is turning AND if the crown and bevel wheels are connected, the Archimedes screw raises the water a height of 1.5 meters, allowing it to flow into the Ring Canal. At maximum capacity, it can pump 60,000 liters of water per minute.

10. The crown wheel:
This is the gear wheel attached to the bottom of the upright shaft. The crown wheel turns the bevel wheel attached to the Archimedes screw (9). However, it is possible to separate the crown and bevel wheels, by turning the small metal wheel which you see through the glass doors. It is therefore possible to allow the sails to turn without pumping water.

11. The stage:
The wooden platform surrounding the windmill 7 metres above the ground is called the stage. It is one of the miller's main working areas. From here he can operate the brake (4), turn the cap of the mill (6) and add or remove the canvas sails.

12. The automatic sluice door:
This flap is to prevent the water which has been pumped up into the Ring Canal from flowing back to the lower level.

Rembrandt and the mill

At the loft "Rembrandt in the attic" it is possible to watch the presentation abou Rembrandt's life and work.
The film about the life and work of Rembrandt is available in several languages Please ask a member of staff to start the film in an appropriate language for you.

We know that Rembrandt liked to work in and around he village of Sloten. His wife's uncle had been the vicar in Sloten and it was while living with him in Amsterdam that Saskia van Uylenburgh met Rembrandt.

Also, Rembrandt's granddaughter Titia was married in the village church.

This is a view of Amsterdam seen from the Kadijk, with the windmill and warehouses of the Dutch East India Company and the Dutch West India Company. On the left are the Montelbaans and the Oude Kerk towers.

Please don't forget to pay a visit to the **Kuiperijmuseum** next to the mill.