Below (Hang up picture gallery)
Associations with the word "mill"

1. Grinding grain

That is not really wrong, because throughout time living beings have always depended on crushing edibles to obtain food, so that each being has its own natural 'mill' in the form of its teeth. So, evolution has even invented a kind of natural grindstone too: for example, chickens pick up little stones to grind the corn in their stomach.

But the versatility of mills leads to a system of naming them by function: oil mills, tan mills, paper mills, fulling mills, saw mills, paint mills, powder mills, pumps, (after the invention of the camshaft) hammer mills and last but not least: electricity generation (as early as 1896)

and for any musicians out there, a little treat: organs with windmill (picture)

and for the theologians: prayer wheels (picture) according to the motto: if the good Lord wants to hear a prayer, he can help himself with a wind.

2. The 2nd association is windmill.

That is not entirely wrong either. As they had to be built in open fields and as high as possible, they often became landmarks for the locations that could be seen from afar.

But, in fact 'mill' is a generic term for the first machines. This consideration leads to a second system in the naming of the type of energy generation: friction boards, pestles, hand mills (example), tread mills (image), horse mills (slow movers), windmills, watermills, and mills run by engines.

Back to the grain mills: Their importance for the provision of the ruling class was documented by legal regulations.

In the middle ages it was laid down by law that only the prince was allowed to grind or mill in a district. In Germany this law was called the '**Mühlenban'**. In contrast, there was the '**Mühlenzwang**', which was the peasants' obligation to use the feudal lord's mill.

In the most important law book of the Middle Ages, the **'Sachsenspiegel'**, it says

Whoever steals from a mill will beaten on the wheel!

There was also the concept of mill asylum, comparable to church asylum.

In the Benedictine Rule of Order was written: every monastery must operate a grain mill!

Interesting information about the history of windmills

- because of the large number of post mills in Germany, it was long assumed that the windmill was a German invention. But this is wrong.

The oldest windmills are said to have existed near the ancient Egyptian city of Alexandria. (Its age is estimated at around **3000 years**).

- the oldest reliable mention of a windmill in Europe comes from Normandy and the year **1180**.

The first documented mention of a post mill in Germany dates from 1222 in Cologne.

- **A dramatic development**: In 1882 there were a total of 18 579 mills in the German Empire

- the Mülleiergenossenschaft Deutschland (a cooperative) registered 7560 mills at the end of 1911.

- **today nearly 1 000 mills remain** in more or less good repair and only a few of them have the possibility to grind.

The most important types of windmill

If you do not deal with windmills, you will probably not notice that there are different types. A windmill is just a windmill. But the more you look into it, the more diverse the landscape of windmills becomes, as the following pictures illustrate clearly.

Windmills with vertical axel shaft

- this is a type of mill that was built in the Asian region. A probable advantage is the direct drive of the grinding gear (millstones). A probable disadvantage is the comparatively small sail area and the presumably complicated brake mechanism.

Mediterranean model (sail windmill or tower windmill)

- the drive consists of a round timber as the main shaft, four smaller round timbers which were put through the shaft.
8 wing rods which were stabilised with ropes and covered with triangular sails.
The wings could not be turned into the wind.
But this was not necessary, as the wind practically only comes from one direction.
-Because the wind direction changes in our latitudes, the mills also had to be able to be turned into the wind. The necessary technical development led to the German windmill or 'Bockwindmühle' (more details later).
Only this much: The mill box stands on a trestle and is turned on a codend.

Coke or coker windmill

A massive substructure and on top of it practically a small trestle windmill.
Its main use was to drain the polders in Holland, which is why it was also called the Dutch maiden.

Dutch mill

Only the bonnet or top can still be rotated by a crank mechanism, a codend or wind rose. The comb wheel drives a vertical shaft, the main shaft. The grinding mechanism is driven by this main shaft.
Distinction between gallery, ground, cellar, wall or roof Dutch mill.
- Because of its octagonal foundation, it is also called an octagonal windmill.
- The mill building is conical at the top and is usually higher than in other types. At least 4 storeys, called floors or basements.

Paltrok mill

The the outer appearance of the windmill resembles the long overcoat worn by immigrants from the German *Pfalz* (Palatine) into the Netherlands and therefore it is called: Paltrok mill.
Instead of the trestle, there is a round foundation of masonry on the floor. On top of this is a cast iron roller track with internal cogs / gearing on which the entire mill rotates.
- in most cases it is automatically turned into the wind by a wind rose.
The disadvantage of this type is the constant change of direction of the mill entrance. In case of carelessness and rapid changes of direction, it has even happened that vehicles and horses have been slain by the blades.

Trestle windmills from the beginning of the 12th century onwards

Since in Europe, apart from a few coastal regions, it was impossible to operate mills without rotating wing surfaces due to the constantly or at least frequently changing wind directions, a way to turn the mill into the wind had to be developed.
The solution: The whole mill box was turned with the help of a codend.
Our type of mill, a peg or post windmill, was the predominant technology used for about 500 years.
An important advantage: Since the entire mill was constructed of wood, it could be dismantled and rebuilt at another location This was especially important in times of war, but also because of

the cities' ever-increasing need for space due to population growth. Many windmills that had previously stood in a good windy location became windless as nearby development increased and took away the wind from the mills. Consequently, many windmills were dismantled and rebuilt in more favourable locations.

A problem: because the peg mill stood on the ground without any anchoring with the ground, it was always in danger of being blown down by a storm. In Münster, the city of windmills, a strong storm toppled three such peg mills on 8 December 1703. So, even today, there is an important rule:

The miller must always anticipate the wind at least 10 minutes in advance!

Avoiding a danger: they tried to avoid this danger by sinking the entire mill frame and the pivot into the ground. The disadvantage: the mill box was close to the ground, where the wind was weaker, and anyone who got too close to the blades took an involuntary merry-go-round ride. In addition, the beams of the buried trestle rotted very quickly.

Now let us leave the historical and turn to the concrete example of this peg mill here:

- the foundation is 1,6 m long, 0,8m wide and 3m deep and is always aligned with the cardinal points
  - and the north-south direction is always the upper sill.
- cross sills
- small trestle struts and large saddle struts
- saddle which serves as a grinding wheel on which the box rotates
- the house tree (or the trestle) as the central element that supports everything
- the stairs
- the codend

(small **task**:)

The windmill trestle

It is the most important part of the mill. It lies on the saddle and makes it possible to turn the wing surfaces together with the mill box into the wind with the help of the codend. In larger windmills like ours, the turning is facilitated by a winch (reel).

The trestle with saddle has a weight of approx. 5.9 tonnes with a volume of 6.3 cubic metres.

The sailcross (vane)

- Has an iron cross (called: Bruststück) for two stocks near the house (called: Hausruten) and the two stocks before them (called: Sturmruten)
- the stock divides the sail in the front with the windboards (they draw the sail) and the stern with the canvas (they push the sail)
- with our sail size (nearly 74 m²) the pressure on the sail surfaces is:
  - at wind force 4 (25 km/h) approx. 570 kg
  - at wind force 9 (75 km/h) storm 3500 kg
  - at wind force 12 hurricane (110 km/h) 8000 kg

  The usable performance at wind force 4 is 11,5 kW

(**small task**: set the sail)

Of course, there were technical developments in the sails, but I do not want to go into these in detail. These were with sail gear, with jalopy gear, with door gear, mainly at BWM divided into lower door, middle door, storm door and maiden door, with swivel tail (Ventikan wing) Biplane wing as basis.
The construction of the windmills required outstanding craftsmanship and a high level of theoretical knowledge, just as used to be found mainly in monastery workshops.
All the wooden joints for the construction of the windmills were artistically conceived and specially specially designed for each purpose. They had to be executed very precisely.

Here are a few wooden joints that we can also see here: (images)

- Offsets, here at the trestle supports, the forehead offset executed as chest offset, heel offset, forehead and heel offset.
- Dovetailed combing on the flour bars on the hammer and on the large corrugated beam at the front and on the saddle.
  corrugated beam at the front and at the saddle
- tenon joints as cross joints secured with wooden nails also called Antonius cross and mainly to be seen on the mill box
- the claw tenon at the bottom of the house tree
- the overleafing, e.g. on the cross sleepers These are still widespread in the carpenter's trade today.

Ground floor in the mill

The box of the mill weighs 13,66 t without the roof and measures 16 m³ (cubic metres)

Weight of exterior boarding (larch): 2.3 t by 3.6 m3 about 2400 forged nails hammered in 200 wooden nails for the tenon joints.

- Storm end front prehn stand
- Moon side behind
- The maiden pillars enclosing the hammer
- The crown columns supporting the roof slats
- rising side seen from the rear left
- Outgoing side seen from the back on the right
- Flour floor
- Stone floor

Here below you can see into the grinding chamber,
- the oak beams are the holding device for the spur beam, which can be adjusted in height by means of the stone spindle.
In the spur beam we can see the spur bearing.
The mill iron is guided by a stone bush in the floor stone.
The upper runner stone lies on the mill iron.

Furthermore, we have an Askania classifier here.
This type of machine was invented in 1903 by the master millwright Heinrich Hecht in Radegast (Saxony-Anhalt) especially for small mills. Here, the screen forms a fixed frame that is part of a horizontal cylindrical shell, in which a kind of rotor turns at high speed. This rotor or beater mechanism throws the ground material against the sieve; the finer parts penetrate through the sieve covering to the outside, while the coarser parts are thrown out of the shell to the rear by

slight bevels on the beater surfaces. The screen frames are removable for changing the covering and cleaning the machine.

Most of these machines, including this one, have two screen sections. In the upper sieve section, the coarse grist and bran particles are separated out first. Flour and semolina fall below - housed in the same cabinet-like machine housing - into the second sieve compartment and are separated there. The sifting effect here is very sharp, which is why one got by with a considerably smaller machine size than with hexagonal sifters."

Upper floor in the mill

The machinery

In a mill the stone assembly is driven by the machinery. The great head wheel (3,8 m in diameter) is fastened on the windshaft and around the head wheel the break is placed. All together it weighs 5 t. The stick gear sits on the claw iron, which is guided at the bottom by the mill iron and is engaged in the iron beam at the top.

The gear ratio is 87 to 11 in order to achieve the necessary speed of the grinding gear. The oak rod shaft lies on the large corrugated beam or weather beam at the front and on the small corrugated beam at the back.

- in two cat bricks, low maintenance and also in wet operation flawless, which are lubricated with pork rind fixed on top.
- Shaft head and bearing at the rear made of cast iron.

The grinding gear

This consists of a bed stone and a runner stone /overdrift stone. We have an overdrift stone, so it suitable for grinding coarsely or graining meal. We have the best result with wind force 4 (that´s nearly 25 km/h), because then the performance is 11 kW. That means 120 revolutions per minute for the runner stone and thus nearly 500 kg grain per hour can be managed.

The grinding chamber also includes the stone rim, the stone vat, a wooden box in which the stones are placed, and the hull stuff consisting of a hopper with a vibratory shoe, which is used to transport the grain evenly into the grinding chamber.

The brakewheel

The most important function of the mill is to be able to brake

- To stop the mill, the brake is arranged around the wooden comb wheel.
- The brake is a wooden hoop that can act on almost the entire circumference of the comb wheel.
- the effect is intensified by the rotary movement of the wheel, the press ring is pulled and pressed around the front surface of the comb wheel
- it consists of the press stem and press shoe, which hold the press ring
- it is released with the help of the pressing bar
- as a rule, stop in 6 revolutions. Otherwise there is a danger of fire
- Backstop (if wind from behind, as brake only works in direction of rotation)

The stone crane

- Consists of wooden gallows next to the grinding gear.
- The stone crane hangs from it with 2 claw irons and pins that are inserted into 2 opposite holes of the runner stone.
- The stone is lifted by a hand spindle and moved aside with the gallows.
- The claw iron is shaped so that the stone can be turned 180 degrees.

The sack hoist

-it has a shaft to wind up the sack and a wooden disk with a rope to pull

(**Task:** Operating the bag hoist)

The roof

Weight of the rafters: 1.22 tons and 1.44 cubic metres

- they are curved to adjust the radius of the head wheel.

Weight of the shingles oak 2,7 t and 3.2cubic metres

- roofed with 40 cm long split oak shingles
- - laid in 3 layers of various widths from 8 - 20 cm

Shingle requirement approx. 80 m2 corresponds to approx. 640 width metres approx. 5000 pcs.

Our post mill

- Built in 1848 (March Revolution Frankfurt Paulskirche first drafts on which our present Basic Law is based)
- in operation until 1905, then destroyed by a whirlwind
- 1939 operation also possible with electricity
- 1948 End of wind operation
- 1952 dismantling of the sails
- 1960 End of flour operation
- 1980 End of grist operation
- 1994 Closure
- 1995 Dismantling of the mill
- 2008 Ideas competition of the city of Borken
- June 2009 Foundation of the association with 22 members
- August 2009 Purchase/collection of the mill from Paunzhausen
- October 2009 Building application submitted
- 2009 to 2011 Restoration of individual beams and assemblies
- December 2011 Building permit
- January 2012 Preparation of the mill site 170 lorry loads of sand,
- Beginning of 1. 2012 Grant from the city of Borken
- March 2012 Laying of the foundation stone with great public interest
- June 2012 Erection of the trestle
- August 2012 Erection of the mill box
- November Start of production of oak shingles about 5000 pcs.
- March 2013 Installation of sail shaft comb wheel
- Straightening Closing the roof
- June 2013 2nd grant from the city of Borken
- August 2013 Roofing
- Sails December 2013
- January 2014 Fencing the area. Training to become windmillers

Total costs: 220 000 € Total hours: 6 500 h