

## **Land of the Windmills Project – Polkey’s Mill on the Reedham Marshes.**

Back in 2001 I was lucky enough to tender successfully for the restoration of two drainage mills for the Norfolk Windmills Trust : Polkey’s Mill and Cadge’s Mill at Seven Mile House on the Yare. This year will see the completion of the authorised work, and a Norfolk drainage mill returned to working order for the first time in sixty years.

### **Polkey’s Mill.**

The restoration of this mill has been to me the most exciting part of my involvement in the L.O.W. project. Although in poor condition, the mill retained its original working sails and most of its machinery. This meant that I was able to copy the original work in most cases, making the restoration as accurate as possible.

Having commenced work, I was fascinated to find that, although the mill appeared to be a product of the late Victorian era, it was actually much older, and even contained substantial evidence of an earlier mill. The timber-work of the first and top floors had clearly been constructed from the re-used components of a former wooden smock mill! These timbers consisted of old floor beams, cross-bracing, studwork, and even pieces of sail whip. After careful examination and measurement, I was able to make a conjectural drawing of what the old smock tower might have looked like.

The cap of the mill was framed in oak, and had a fantail to turn it into the wind. Closer examination revealed that the cap frame had been designed for tail-pole winding, and had been converted to fantail winding at a later date. There was strong evidence that the mill formerly had a very large “trundle-pegged” wallower, and a brake wheel (locally head wheel) of a similar size. Such wheels are associated with common sails, which ran faster than the later “patent” sails. The mill today possesses a cast-iron brake-wheel with wooden cogs, and a much smaller cast-iron wallower. The existing cast-iron wind-shaft seems to date from the previous set-up, as an extra flange has been added to accommodate the present brake-wheel in its position nearer the centre of the cap.

The mill has a “steady bearing” about halfway down its upright shaft, the latter being made in two pieces with a coupling. My attention was drawn to the beams carrying this bearing by their oddly tapering shape. My suggestion is that these beams are actually parts of the “winding beam” (locally “cross breast”) of the tailpole-winded cap. The winding beam is fastened across the cap sheers near the middle, and projects evenly each side of the cap where it carries the two long braces that reach down to the tail-pole near its bottom end. It seems that this large beam was taken out of the cap and cut in half when the fantail was fitted, and used to carry the steady bearing instead.

The tower of the mill has clearly been raised by adding more brickwork to its top (locally “hained”) This may have happened twice, as there are two distinct layers of brickwork above the top floor. The first layer contains many re-used

bricks, which may indicate a re-build rather than a raising. The taper of the tower is maintained in this layer. The second layer is clearly a raising, as the bricks are different, and the first offset course under the former curb remains visible. The taper is maintained initially, but then the tower becomes vertical, and then slightly splayed out. Thus the curb is slightly bigger than the minimum diameter of the tower! This second raising of the tower is approximately equal in height to the cast-iron section let into the two-piece wooden upright shaft above the coupling. Clearly the shaft was made longer by inserting this cast-iron section to cope with the increased height of the tower. I would hazard a guess that the existing cap frame was retained during the process.

Restoring the mill presented a substantial challenge. Although it had been given an aluminium roof during the "Windpump Protection Programme" in the 1970s, it had been roofless for at least 30 years before. The ingress of wind and weather had rotted the floors severely, and these had to be completely rebuilt. The cap frame, on the other hand, had survived well despite its exposure. Norfolk oak seems to be particularly durable, and only the tail beam was beyond repair.

An attempt at house conversion in the late 1950s caused more damage. The mill was sold for £35, and the first action of the new owner was to smash up the cast-iron pit-wheel, crown-wheel and cistern for scrap. Fortunately the scoop-wheel shaft and scoop-wheel were spared, but the cogwheels had disappeared and the only evidence of their design found was a single wooden cog from the pit-wheel. Their relative diameters could, however, be calculated from the positions of the mountings on the shafts. The house conversion plan got no further than this, although I was told that some flowers were planted!

Most of the windmill had to be taken to pieces to repair it. The sails came down followed by the cap and curb, and the aluminium roof was put back to keep the rain out. The floors were dismantled and taken away to my workshop, where it was possible to repair much of the timberwork by scarfing and gluing in new sections where rot was present. It was thought important to save as much of the original timber as possible, bearing in mind that most of it had come from an earlier mill. The timbers were re-installed, new timbers put in where necessary, and the floors covered with new floorboards.

The curb upon which the cap turns was in a very poor state. The two-layer wooden ring was eaten away by death-watch beetle, and the cast iron track on top of it was broken into many pieces. Only the segments of cog-ring bolted to the outside were serviceable. A new wooden two-layer ring was made from seasoned oak, the segments being held together with "secret bolts" and dowels. A new segmental track was cast in malleable iron and bolted on top. The original cog segments were cleaned and repaired, then bolted to the outside. The completed curb was lifted on to the repaired brickwork, set level and bricked under.

The brick tower was thickly covered in ivy when work commenced. The ivy was removed to reveal fairly sound brickwork that was in need of re-pointing

and some repair. Raking out the joints was difficult due to the hardness of the remaining mortar, but was achieved using hammer and plugging chisel. Despite the hardness of the mortar, many voids had appeared, necessitating the removal of large areas. Some of the facing bricks had spalled or eroded, and these were cut out and renewed. After many weeks work, two coats of tar were applied to the exterior.

The cap components were taken back to the workshop in Essex. Fortunately, I was able to repair the timbers by cutting away the rotten areas and gluing and dowelling in new dry oak sections. Once again, death-watch beetle was mostly responsible for the destruction of the wood. One of the sheers was so weakened that a steel "flitch plate" had to be inserted into it. The plate was embedded under the surface, bolted through, and hidden by oak glued in place.

After repair, the cap frame was assembled with a new oak tail beam made to the old pattern. The rollers upon which the cap turns were badly worn, and had either to be renewed or re-machined. The cap was set up on the new curb so that its ability to turn could be checked. The centring rollers were mostly serviceable, but a new steel "tyre" had to be shrunk on to one of them.

While in the workshop a new roof was made for the cap. Only part of the front gable-end of the old cap remained, but the curvature could be ascertained, and the ridge shape deduced from old photographs. Polkey's Mill had a very shapely cap with pronounced curves, even on the studwork of the front gable. Every attempt was made to achieve this shape in the new work, and I leave it to you to judge whether we were successful.

Little remained of the fantail staging, and some of the gearing was missing. The new fan-stage was built on to the cap in the workshop, the tops of the timbers rising high into the roof of the barn. The gears and shafting were set up, then the whole cap dismantled ready for transport to the site.

The access to the site is via a concrete farm road that winds across the marshes from Wickhampton church. There is a level crossing near the mills that is very hump-backed, and this, together with the narrow road limits the size of vehicles that can be taken there. Articulated lorries and large cranes are "out", and this has a bearing on what can be done at the mills.

Unlike many recent mill restorations in Norfolk, it was not possible to complete the cap at ground level and then put it on with a crane. Only a relatively small crane could make it over the level crossing, so the job had to be done in small "bites." The cap went on in four parts: 1) the base frame 2) the fanstage 3) the brake-wheel 4) the wind-shaft. This process was completed in one day on 4<sup>th</sup> August 2004.

Once the basic elements of the cap were in place, it was possible to complete the work. The ribs and roof were put together and the new pre-painted cedar weather-boarding put on. Further coats of paint gave protection to the new wood.

Deteriorating weather in the autumn put paid to further outside work. The fantail gearing was completed, and attention was then focused on the internal machinery.

Earlier, a new 2-piece, 10ft diameter 80 cog mortised pit-wheel had been cast, cleaned up and bolted together in the workshop. This was now moved into the mill and put in its position in the wheel pit. It was wedged in place ready for the wheel-shaft to be re-installed. The shaft had to be “threaded through” the two scoop-wheel centre castings and the pit-wheel itself before being put to rest on its new gun-metal bearings. The scoop-wheel centre castings were suspended from the canister while the 1-ton wheel-shaft was drawn into place.

A new one-piece 4ft diameter 33 tooth cast-iron crown wheel had also been made to drive the pit wheel. This had to be “threaded” on to the old wooden upright shaft and held in place with wedges. To do this, the shaft had to be supported on jacks while the bottom bearing arch was taken out to allow the wheel to be slid underneath and raised to its correct height.

The above wheels and the original brake wheel and wallower had all to be adjusted to run true, and then finally wedged on to their respective shafts. The next step was to fit new wooden cogs to the brake-wheel and pit-wheel. This is a time-consuming process involving a lot of hand work.

The new cog blanks (with oversize heads) have to be fitted accurately into the mortises in the wheels, which are often not very well formed. Once the blanks are in place, the wheel can be turned, and a fixed marker used to scribe on the correct face width and height. Once the surplus wood has been cut away, the cogs can be “pitched”. This involves scribing another line, and using a set of dividers to mark the centre line of each cog. The dividers have to be set by trial and error and “walked round” until the cogs are marked so as to be equally spaced irrespective of the position of their mortises. Once this has been done, the correct cog profile can be marked on and the cogs chiselled to their final shape. When finished they should be all the same, and mesh smoothly with their partner wheel.

Four sails remained on the mill, rotten but more or less complete, until the restoration started. These were the originals from when the mill last worked, and their survival allowed accurate copies to be made. So often nowadays a windmill’s sails are changed at the whim of the millwright every time they have to be renewed. The sails on this mill are unusual in rotating clockwise when viewed from the front. This was a feature of the early mills built in the Fens, and may be significant in identifying this site as an early one.

The new sails for the mill were made during the winter of 2004/5. The sails are very large at 9’ 6” (2.9m) wide and 31ft (9.45m) long. The total span is about 70ft (21.34m). I use a large timber-framed Essex barn as a workshop,

and by the time all four sail-frames had been made up, it was nearly full! A solution to lack of space was found by suspending two of the sails on ropes, and hauling them up into the roof.

The "patent" sails were filled with 224 wire-framed canvas-covered shutters or "vanes" and all these had to be made from scratch. The womenfolk were enlisted to stitch and tack the canvas in place, and to paint the completed shutters. This work took over a year to do, and required patience and dedication from those involved.

The stocks that carry the sails are the longest I have ever worked on. At 60ft (18.28m) long they must be the longest on an English windmill at the moment. (Berney Arms Mill's stocks may have been longer). The timber selected was Douglas Fir, and the trees were felled in Wales. Richard Seago kindly let me store the baulks at South Walsham pending bringing them on to the site.

Once on site they were tapered and finished, together with the 24ft (7.32m) larch clamps. Preserving, oiling and painting took some time, but they were finally hoisted with a crane on 9<sup>th</sup> August 2005.

As the mill stands now it remains to fit the sails and shutters, fit the fan and rebuild the scoop-wheel and its hood. When this has been done it will be possible to have a test run and try everything out. I am indebted to all those who have helped me with the work, particularly Bob Self who I have kept so busy over the last few years that his own windmill at Halvergate has been rather neglected.

Eventually Polkeys Mill will form part of an open-air museum of drainage. At the 7-Mile House site there will be 3 windmills in various states of completeness, the steam pump fitted out as a visitor centre, the diesel pump recently moved here from downstream and the present-day electric pump. Polkey's Mill and the diesel pump will be able to pump water to demonstrate their capabilities to visitors arriving by water. The whole site should be up and running for the 2006 season.

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