The Restoration of Thorpe Watermill, Bothwell, Tasmania

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Thorpe Watermill is the only known Australian example of a traditional water-driven flour mill, that can be operated in the original manner.[1] This uniqueness results from restoration work that was undertaken during the 1970s by the Bignell family, who own the mill. The work was carried out particularly by John and Peter Bignell, with very few resources. In February 1988 the editor of this Journal visited the mill and persuaded John Bignell to write this account of how the work was done. Professional conservationists may debate some of the methodology but the achievements of this private restoration project deserve both respect and gratitude.

John Bignell is a farmer, running Thorpe Farm, near Bothwell, north of Hobart.

HISTORY

Thomas Axford, who built this mill in 1823, arrived in Hobart Town on 23 November 1822. He, his wife and family had travelled from England on the brig *Christiana* and among other passengers was his brother-in-law Frederick Slade R.N. (Thomas Axford had married Martha, one of the nineteen children of John and Deborah Slade). In making an application for a grant of land, Axford claimed that he had 'means' amounting to 587 pounds and on the same document gave his address as Abingdon, Berkshire, England. His wife Martha also came from Berkshire and it was from the Slade family farm at Aston Upthorpe, Berkshire, that the name 'Thorpe Farm' was derived.[2]

Axford immediately set about building a watermill and Archibald McDowall jnr later recalled that it was well established by 1825. Dr Ross's *Hobart Town Almanack* for 1830 also refers to Axford's 'excellent cornmill'. Axford ran his mill until 1865, when he was murdered by 'Rocky' Whelan, the bushranger. His son, Thomas jnr, lived at Thorpe for some years but then left and the property passed on to the Chamberlen family: Mrs H.J. Chamberlen being Thomas jnr's eldest sister. After the death of Henry Francis Chamberlen in 1899, the estate was at first let to Frederick McDowall (grandson of the original Archibald McDowall who had taken up the adjoining block, 'Logan', in 1824). Finally, Frederick records in his journal of 1899 that he agreed to buy 'Thorpe' (800 acres [324 ha]) for 3250 pounds. This purchase of course included the mill, which he operated until 1907 for grinding wheat and until 1916 to cut chaff.

The mill is now owned by Mr and Mrs Jeffrey Bignell, whose sons (great grandsons of Frederick McDowall) have been responsible for the restoration.

HISTORICAL RECORDS

We are fortunate that several significant written and photographic records of the mill still exist. Also, at the time of the initial restoration, there were still a few old people alive, including my grandmother and great aunt (Fred McDowall's daughters), who could remember the mill operating. Unfortunately, they had been only children at the time, so were unable to provide any technical advice on the mill's operation. One exception was the position of the bucket elevator, which my grandmother could still picture trundling around near the front door. We still cherish their descriptions of the old bearded miller, perpetually covered in flour and surrounded by ducks cleaning up the spilt grain and flour.

Following a bit of press coverage, an Axford descendant, Mr Douglas, very generously presented us with a section of Mrs Martha Axford's daily journal. In this she details her daily chores, such as bread making and eel catching, as well as the numerous problems associated with running the mill. On one occasion the only help they could find was a one-armed convict. About twenty years ago we found another old book in the original and now derelict homestead and this was the miller's account book for 1868. Each page was used for one customer, so that once his best customer filled his page the rest of the unused book became useless for accounting. In those frugal times such wastage could not be afforded, so he reversed the book and used it for his daily journal, using up whatever space was left on each page.

My great grandfather, Fred McDowall, maintained a daily journal for almost his entire working life from the 1880s to 1930. Once he had purchased Thorpe Farm and its associated mill, there are numerous entries relating to the operation of the mill. It appears he employed professional millers but often helped with the heavy work of grain handling, raising and dressing the millstones and cleaning out the water races. Milling was obviously a very dry job, and Fred often had to mount an expedition to the pub to locate his missing miller. After one such session the miller fell from the weir into the flooded Clyde River, which would have been a rather sobering experience at 11.00 p.m. in July. My great aunt Madge Downie (nee McDowall) managed to find three old photographs of the mill taken early this century.

Apart from these few clues, the major sources of technical information to guide us through reconstruction were numerous modern milling publications originating in England, where there are still many intact mills and the necessary milling skills never really died out. Very early in the project, I became a life member of the Wind and Water Mill Section of The Society for the Protection of Ancient Buildings (U.K.) and they continue to produce a wealth of milling literature from 20p pamphlets to 20 pound books. Of course, to a couple of farm boys, like my brother and I, the mill was just a giant Meccano set and all that mud and machinery was all in a day's work.

CONSTRUCTION

The Thorpe Mill appears to have been built to the standard European design of three storeys: consisting of the granary (storage) floor in the attic, cleaning floor in the middle, and stone floor at ground level, with the 'cog hole' almost in a cellar. The mill is built of handmade bricks standing upon dressed sandstone foundations. All the internal timberwork is pit-sawn hardwood, with the exception of the milling machinery. According to my late Great Aunt Madge Downie (the little girl seen in Figure 1), the clay for the bricks was dug from the tail-race, and the existence of a large swampy hollow infested with willows tends to verify this. The presence of a long-disused rubbish tip at the same spot, also suggests the one-time presence of a big hole

Fig. 1: Thorpe Watermill in 1910. This photograph shows the western side of the building and includes several skillions that no longer exist. The little girl on the pony is Madge McDowall (later Downie), a great aunt of the author. In the foreground is the washout indicated on Figure 3.

Apart from machinery hire to repair waterworks, the re-roofing was the major cost in restoring the mill and was the only time we employed professional help. All subsequent work was carried out by members of the family and by any unfortunate visitor who happened to come along during digging or rock-breaking jobs. However, the majority of the work was done by my brother Peter and myself. Once we became obsessed with finishing the task, we devoted to the mill almost every weekend and spare minute from farm work for about three years (Fig. 2).

Some credit for inspiring us to restore the mill must also go to an old Yugoslavian flour miller from Melbourne, Milan Posavec, who tracked us down during his search for a suitable mill in Tasmania to expand his stone-milling business. It was he who first showed us how the millstones actually worked but sadly he could not understand our desire to retain the mill in its original form and so he finally gave us up in disgust.

suitable for filling. The lime for the mortar probably came from the local limekilns, which are about 5 km away and still very well preserved.

The biggest cause of deterioration to the mill can be attributed to the introduced European willows, which now choke the Clyde River for its entire length through the Bothwell Plain. These trees have a very powerful root system, growing from both the seeds and broken branches, and creating an almost impenetrable jungle along the river. I understand that in parts of New Zealand they have been declared a noxious weed and they use helicopters to spray them. I can well appreciate such drastic measures, because these trees had completely blocked the mill-race and forced the river to leave its proper course to take a shortcut straight into the mill and tail-race. By the 1970s, the mill was virtually standing in water for twelve months of the year, with the 2 m high waterwheel completely submerged and, along with the cogs, buried in silt and debris. All timber framing (hursting) supporting the cogs, as well as the ground floor, had rotted or been washed away by floods.

Full credit for the initial move to preserve the mill must go to my mother, who took it upon herself to choose and order asbestos cement 'slates' to replace the wooden shingle roof in 1975. By the 1970s the western side of the roof was virtually useless and rain-water was by then running right through the building to the bottom floor, causing all manner of rotting and warping damage. Even with hindsight, and the knowledge of asbestosis, we have no regrets at the choice of 'fake slate'. The necessary labour, skills and trees are just not available these days to produce enough good shingles for such a large roof area. Shingles are also a serious fire risk, especially once they begin to break down.

Because of the cost of the slates, we employed local builders to help install them properly. Unfortunately, the spacing of the battens from the shingles did not match those required for the slates, and so we had the added expense of replacing all these. Thirteen years later, after an initial application of lichen scraped from an old asbestos cement roof, plus a few buckets of cow manure slurry, the roof is now lichen encrusted and fools many a visitor.

THE WATER SUPPLY

Meanwhile, having stopped the influx of water through the roof, the next major requirement for preservation was to put the river back where it belonged. This was achieved with a Caterpillar D9 bulldozer, with which we constructed almost 1 km of levee banks between the river and the parallel water-race. The levees were constructed 30 m away from the river, with the 'take-pit' between the river and levee essentially creating a second river to carry away floodwater.

Expert advice from the Tasmanian Rivers and Waters Supply Commission suggested that it would be cheaper to dig a completely new tail-race, rather than trying to clear the willows from the old one. We dug this right beside the old one, pushing the dirt from the new one into the old. The D9 did in a matter of hours what the poor old convicts must have taken months to complete.

An unusual and seemingly inefficient piece of engineering seems to have occurred in the siting of the mill (Fig. 3). The head-race is only a few hundred metres long, while the tail-race is about 1.5 km long. This meant that the tail-race had to be dug 2.5 m below ground level adjacent to the mill and then extended for the 1.5 km to get back to the same level as the river. The more normal and efficient layout was to extend the head-race, which need only be a constant 1 m deep, for as long as was necessary to achieve the required 'head' for the waterwheel. The mill was then built just above river level, with the tail water virtually dropping straight back into the river.

The water to drive the mill is diverted from the Clyde River, which in turn originates from Lake Crescent, 300 m higher. The rainfall for the district is only 21 inches (530 mm). In about 1833, the owners of the three mills on the Clyde found it necessary to construct a weir and control gate at the outlet of the Clyde from Lake Crescent, and later they dug a canal joining Lake Sorell to Lake Crescent. In 1857 the Clyde Water Trust was set up to ensure a continuous supply of water to the mills and two towns on the Clyde. Today the Clyde Water Trust is one of only a few surviving private river control trusts left in Australia, with the majority of its work these days being the maintenance of a water supply for irrigation. This ongoing interest also ensures a constant supply of water to run the mill and coincidentally my brother Peter has the job of co-ordinating the water release and usage.

About 200 m before the mill, is a brick-framed sluice to allow the miller to release water in the head-race back into the river, without dismantling the main river weir. This facility was traditionally used to trap migrating eels and Mrs Axford used to report her daily catch at the start of her journal. The sluice consists of a 2 m long bricked water race with vertical slots in the sides. The trap apparently relied on creating a type of overhung waterfall between a series of screens, so that the eels could not return upstream once they had gone over the waterfall. I reconstructed it to this design but only ever managed to catch one sleepy tench and a lot of sticks and leaves. Also associated with this sluice was an outlet for irrigation water, to flood low-lying paddocks during our dry summers. This irrigation scheme, which we still use, probably represents one of the oldest schemes in Australia.

Fig. 2: Thorpe Watermill during restoration in 1975. This view is of the eastern side of the building and shows the redug head-race and the new roof. Photograph by Peter Bignell.

Just in front of the mill is another sluice, which holds back the head-race water from the mill when milling is not being carried out. This sluice is essentially an on-off switch, with the precise regulation of the waterwheel speed carried out by a final sluice directly above the waterwheel and operated from within the mill. All these sluices required almost complete reconstruction.

Before contemplating running the mill again, major restoration works were necessary on our weir in the Clyde. The original had been built in two sections on a fork in the river, obviously because two little weirs were easier to build and control than one big one. The main weir was a sandstone frame into which wooden hatches could be dropped to block, back-up and divert the flow. On the other fork, a log had been laid across the shallow river and boards driven vertically down into the mud. About thirty years ago (c. 1958), my father undertook major repairs on both sections, so that water could be pumped from the mill-race for additional irrigation. I have vivid memories of camping on the riverbank as a five-year-old, while my father manned the pumps all night to keep the water out of his cement work.

His time was obviously well spent on his first job but unfortunately we had to repeat the procedure on the other fork of the river in 1975-76. This necessitated sand-bagging the river and keeping the leakage pumped out while we dug down to river bedrock and then cemented footings and side walls for hatches. The cement work was backfilled with fine sand, then clay and finally gravel to prevent further undermining. The head-race to the mill was cleared or re-dug with a bulldozer and backhoe. Where the willows were too big to remove, we just dug around them.

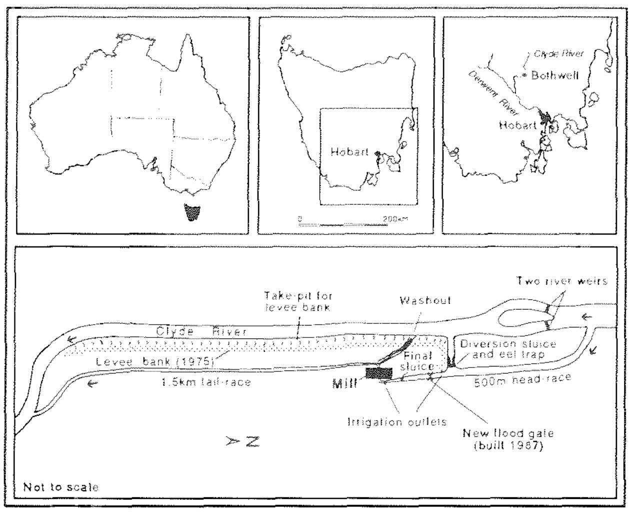

Fig. 3: Sketch-map showing the location of Thorpe Watermill and the arrangement of its races.

THE WATERWHEEL

Having reinstated a controlled supply of water to the mill, the next step was the reconstruction of the waterwheel. It is an overshot waterwheel, meaning that the water enters the wheel slightly past the highest point so that the wheel turns in the direction of the water flow. By contrast, water enters a pitchback wheel before the top and so the wheel rotates in the opposite direction. The wheel in our mill is constructed entirely of wood, except for a set of cast-iron spokes on each end (Fig. 4). The wheel is rather unusual, in that it is as wide as it is high (about 2 m x 2 m). This is obviously the design best suited to a site with limited fall but plenty of water. The wheel is supposed to turn at 8 revolutions per minute and by our calculations develops about 3 kW.

Historical records suggest that it was the failure of the wooden waterwheel axle that caused the mill's closure early this century. The huge log axle is 6 m long and 40 cm in diameter, supporting both the waterwheel and a 1.5 m diameter cast-iron cog-wheel (the pit-wheel). The bearings consist of short iron stump axles fitted into the ends of the log and these obviously ceased to work as the log rotted and wore out. In 1917, my great grandfather brought a new log to the mill to replace the original axle. Unfortunately he was very old by this time and labour was short because of the war, so the log was never installed. The remains of it still lie rotting outside the mill. In 1972 I dragged another log from the bush, and before fitting the end-bearings we had the log pressure-treated, with Tanalith wood preservative, in a specialised tank designed for treating the long poles used for growing hops. This preservative is a mixture of copper, chromium and arsenical salts.

To install the new axle we dug a big trench in the dirt floor of the mill, then dropped the axle into the trench so that it was down level and in line with the waterwheel and cog-wheel centres. We then suspended the waterwheel and pit-wheel with chains from above and threaded the new axle through the middle of them. The job took about three days to complete, being very heavy and exacting work, with several re-runs as the log jammed and had to be pulled back out for

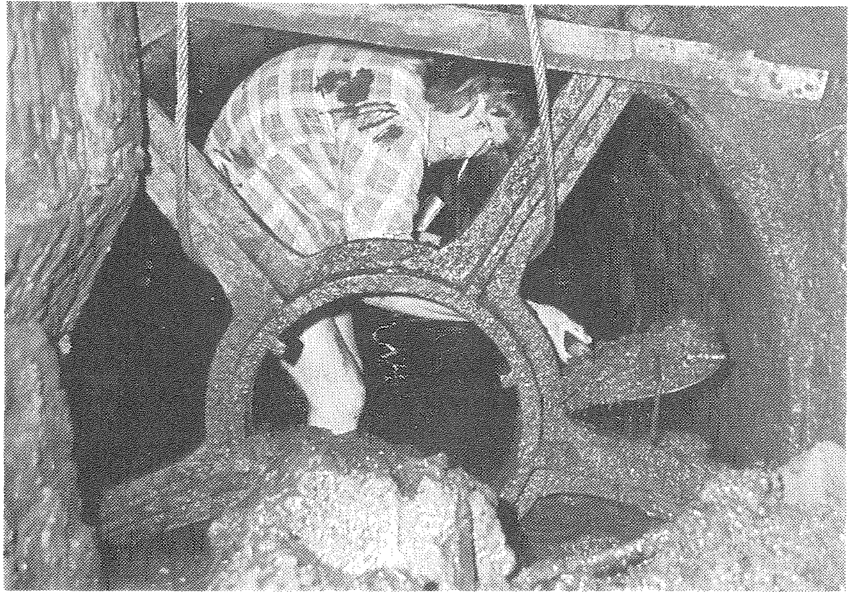

Fig. 4: John Bignell shovelling mud from inside the waterwheel in 1975. Prior to reconstruction, the wheel had become buried in silt and was covered by water. Photograph by Peter Bignell.

further shaping with axe or adze. It must have been mid-winter, as I remember the job was very cold and unpleasant: sloshing about in mud and handling heavy muddy chains and crowbars with the temperature barely above zero (Fig. 5).

With the new axle in place, it was then a matter of centering the waterwheel and cog-wheel upon it. The problem was to connect the odd-shaped log to the precisely shaped wheel and cog hubs. We decided that the best method was to manufacture various steel plates, to exactly fill each gap between axle and wheel hub. When we approached the local engineering shop with our requirements, the old Polish proprietor said, 'Oh no boys, you use wooden wedges'. Another old gentleman present at the time, a retired carpenter, confirmed this by saying that this was how they used to tighten the iron centres of wooden cartwheels. So, armed with a tomahawk and a bundle of Huon Pine offcuts, the previously daunting task was completed in a few hours. The system really was excellent, permitting very accurate adjustments of the huge cog and wheel by knocking wedges in or out on opposite sides of the log. Of course, once the wheel is in regular use the wet timber swells and the job is even more secure.

As stated earlier, the waterwheel is rather unusual in being as wide as it is high. The problem for restorers was that while the two outside hubs are bolted and supported by iron spokes, the centre hub has no spokes and is held in place by virtue of five long bolts going right through the wheel longitudinally. These bolts squeeze and hold all the wheel components together and if they loosened simultaneously the wheel would virtually collapse like a stack of cards. Because of this, it was necessary for us to cradle the wheel in the centre with chains, while we removed various sections for repair or replacement. As each section was repaired, the wheel had to be put back together, rotated to the next bad section, suspended and once again dismantled.

The original waterwheel was built from some unidentifiable pine. As replacement timber we chose either Huon Pine or Celery Top Pine, both of which are renowned for their durability (Fig. 6). Both are famous Tasmanian timbers used in shipbuilding and the latter in outdoor bicycle tracks and even as the spacers in lead-acid batteries. Celery Top Pine was chosen for the hubs because it is much harder than Huon Pine. Where we were unable to obtain timber of sufficient size, we had to join timber with epoxy boatbuilding glue. To attach the inner barrel (sole boards) to the hubs we used copper alloy boatbuilding nails. Once the wheel was repaired, anticipation got the better of us and we made a couple of corrugated iron flumes to carry water over the wheel to drive it. A ripcord was installed and, with due ceremony, my grandmother turned on the water. Amid a great deal of excitement and jubilation, the waterwheel turned once again after sixty years of idleness.

OTHER WORK

From this time, it probably took us another year to reconstruct and adjust all the timberwork and gearing connecting the waterwheel to the millstones. A great deal of mundane work was also necessary, such as rebuilding the bottom floor, the windows, the doors and so on. Not a pane of glass or glazing bar had survived the years but we found enough remains to be able to reconstruct the twelve-pane windows to their original design. To glaze them, I put out a call for any old hand-made glass with its associated bubbles and wobbles. The balance I made up with new glass, 'aged' in an enamelling kiln that I borrowed from the local school. This somewhat experimental technique designed to produce genuine bubbles and wobbles was

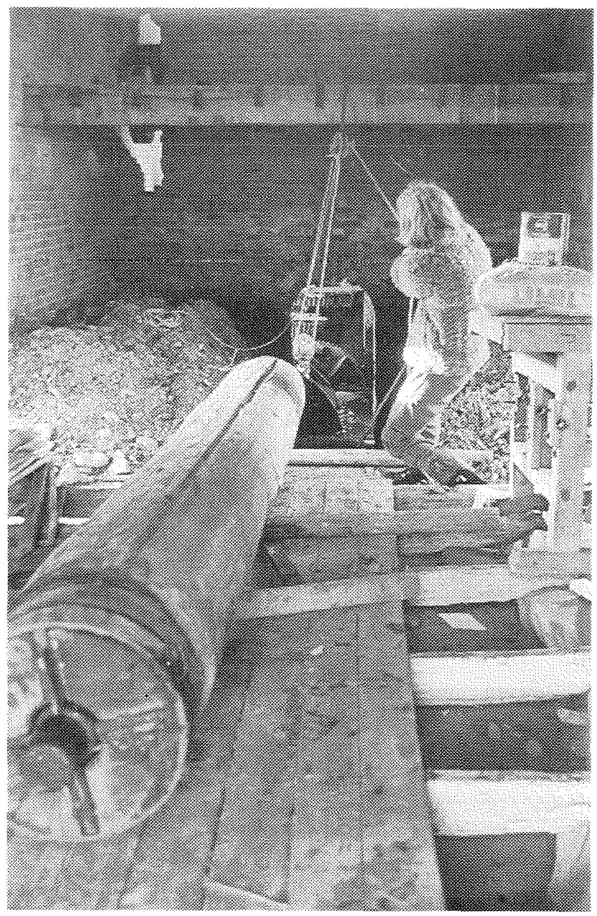

Fig. 5: The new waterwheel axle being moved into place in 1975. It consists of a log 6 m long and 40 cm in diameter. One of its iron end-bearings is visible in the foreground. Photograph by Peter Bignell.

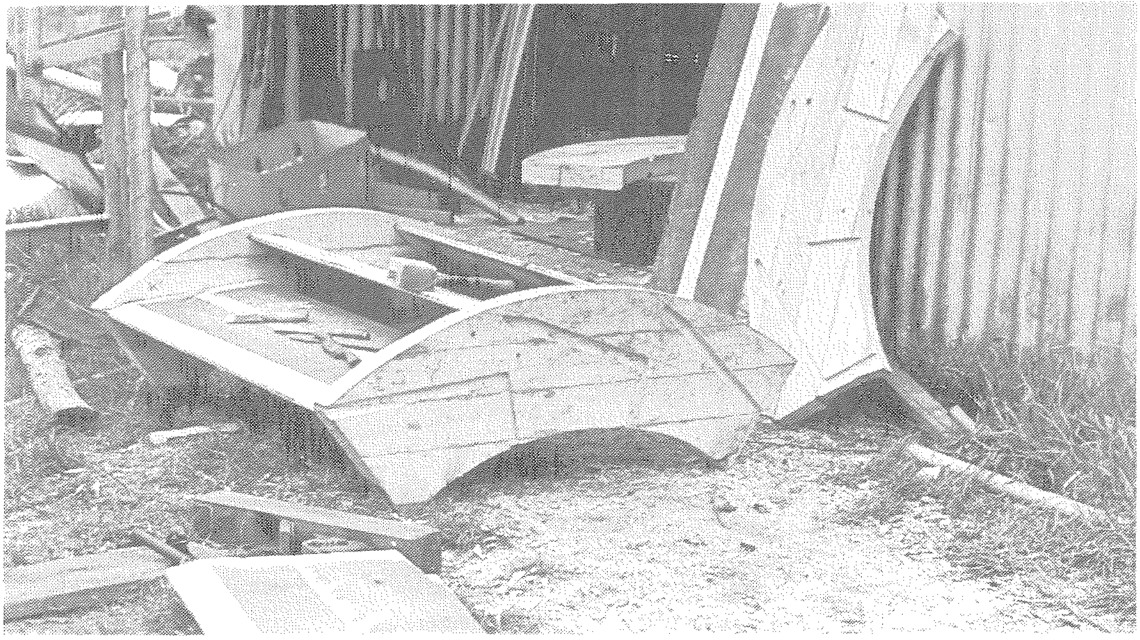

Fig. 6: Making new sections for the waterwheel in 1976. Photograph by Peter Bignell.

eventually successful, but was highlighted by one major melt-down when I produced a solid block of glass fused through all the element wires and firebricks.

Finally, on 17 July 1977, after three years and in the presence of an A.B.C. film crew, we produced our first flour. Since this paper is appearing in an archaeological journal, perhaps I should also record some of the artefacts that were recovered in the course of the restoration work. Over the years of flooding, the waterwheel and cogs had become almost totally buried in about 2 m of silt. While creating tremendous work in digging it all out (Fig. 4), sometimes requiring triple handling, the mud did provide a treasure trove of artefacts. It seems likely that the presence of the pond of water under the mill presented an irresistible temptation to children, both large and small, to drop every loose object they could find into it. As such, I think we recovered almost every missing component of the mill. Having studied every available book on mills, we had a fair idea of the parts that were missing, and were able to recognise or place almost every part as it emerged.

Such vital artefacts included a 'bill and thrift', the special chisel used for sharpening the millstones; the 'damsel', which is a type of camshaft fitted to the top millstone to shake grain into the stones (so named because it chatters while it works!); and a 'jackstaff', which was used to ensure the bedstone was horizontal and at right angles to the drive spindle. As I pulled a giant ring-spanner from the mud, I recognised it immediately as the one required to adjust (tenter) the millstones. As well, we found miscellaneous bearings, tools, pottery, weighing scales, old boots, dead sheep and fence posts.

Another interesting find, away from the mill, was the main brass waterwheel bearing, that my grandmother had been using as a doorstop for as long as I could remember. It was obviously removed during an unsuccessful repair job in August 1916 that we have found recorded in diaries, and had survived numerous house moves and several generations. One of the local 'collectors' did a metal detector survey for me and turned up a single bucket from one of the bucket elevators used to carry meal vertically on a leather belt. This allowed me to reconstruct this piece of machinery to its original design. The other major items of machinery reasonably extant are the Bolter (flour dresser), Smutter (grain cleaner) and sack hoist. The latter is a type of windlass, in the attic, which is driven by the waterwheel via a long endless rope. In the interests of authenticity, we renewed the rope with second-hand ski-tow rope, that my brother Peter had dragged for miles down Mount Field.

CONCLUSION

It is now more than twelve years since the mill first turned again, and in that time Peter and I have both produced families and expanded our farming interests, such that now we cannot imagine how we ever found the time or energy to undertake such a large hobby.

Last year we did clean out and deepen the tail-race, as well as build a flood-control gate in the head-race. Every year we also have to carry out a bit of maintenance to the gearing and machinery and so on. There is still a great deal of work that could be done to the mill, and perhaps when we retire the task can be completed. In the meantime, the mill stands majestically as the centrepiece of the farm, and we can take great satisfaction from knowing that it should continue to do so for another 165 years.

Every summer we open and run the mill for the occasional special interest tour, but essentially we do not have the time to become too involved with tourism. However, if any readers of this journal are in Tasmania, and would particularly like to see the mill, then we are always happy to show genuine enthusiasts. Provided there are no sheep to be shorn or hay to make and provided that the weir is in the river, then we may even be able to produce a bag of genuine stoneground flour for you.

NOTES

1. Thorpe Watermill has been referred to in the literature on a number of occasions. Readers should see: Anon. 1979. Thorpe Water Mill: A Tasmanian restoration project, *Australian Society for Historical Archaeology Newsletter* 9(2): 34–7; Jack, R.I. 1983. Flour mills, *in* Birmingham, J., Jack, I. & Jeans, D. (eds) *Industrial archaeology in Australia: rural industry*, Heinemann, Richmond, Victoria: 27–52; Connah, G. 1988. *'Of the hut I builded': The archaeology of Australia's history*, Cambridge University Press, Cambridge: 131–33.

2. Modern changes in the boundaries of English counties cause both Abingdon and Aston Upthorpe to be now located in Oxfordshire.