Beeleigh Mill Restoration Group

Newsletter

7, 2017

Committee
2016/2017

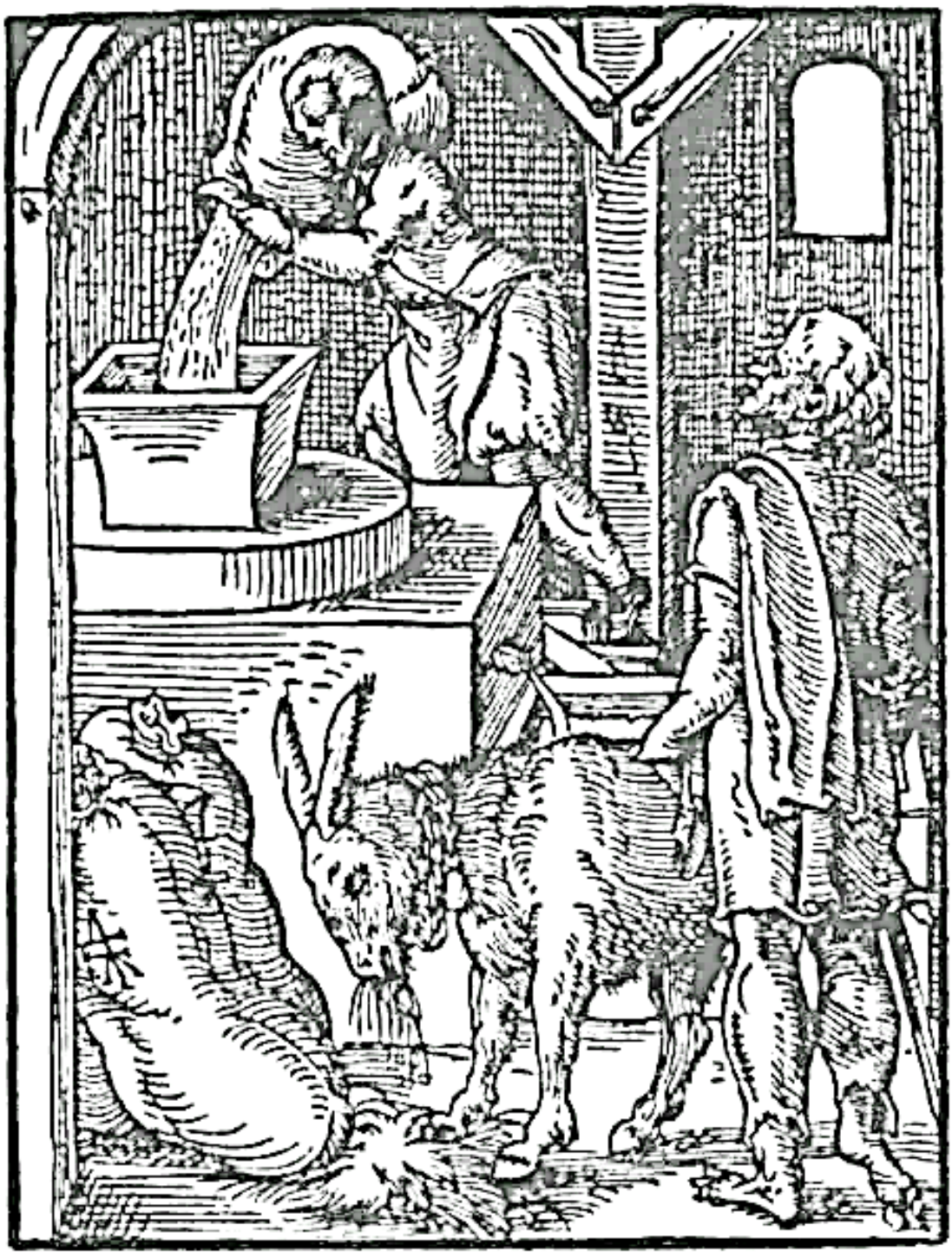
President	Charles Morlham
Chairman	Paul Chaplin
Vice-Chairman	David Morgan
Secretary	James Morgan
Treasurer	Lawrence Tattersall
Millwright	James Owden
Webmaster	Ivor Brearley
Committee Members	Toby Howard, Graham Thorne

Compiled and edited by Gay Tattersall

www.beeleighmill.co.uk

Diary Dates for 2017

Sun. May 14th:	Mills Open Day, 11-4 p.m.
Tues. May 23rd:	Presentation to the Chelmer Canal Trust
Sun. June 4th :	BMRG AGM at 73 Hoynors, 12.30.
Sat. & Sun. Sept. 9th & 10th:	Heritage Open Weekend, 11-4 p.m
November (T.B.A.):	Presentation to the Colchester Society of Model and experimental Engineers



A Miller from a 16th Century Engraving


MUCH · THE · MILLER'S · SON

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Front Cover: An engine for Brahminy. See article, page 9

BMRG Newsletter – Chairman's Report 2017

by Paul Chaplin

Welcome to the 2017 BMRG Newsletter which I hope you will find interesting and inspire you to be a volunteer. There are many ways in which you may be able to help, for example being a guide on open days, researching Beeleigh's history, fundraising, actively helping with the engine or construction work or even joining the committee.

Since last year there has been continuous activity at the Mill for which I would like to thank all our volunteers for their input both great and small. Like last year I particularly would like to thank James for input which goes far beyond being secretarial! His enquiring mind has moved our knowledge of the Mill's history forward again and he has been surveying the hurst and producing drawings in DraftSight (computer drafting software or CAD). I too have learnt to draw in DraftSight and we learn off each other but we are not yet fluent in its use!

One of our committee members, Ivor, has been receiving chemotherapy recently and we all wish him well in his recovery. After much thought and planning and writing method statements, in March, we managed to turn the engine and hurst backwards and forwards through about 45 degrees. We know Ivor was pleased to hear this news as he was instrumental in disconnecting the governor mechanism and lifting the cylinder heads in readiness for this day. We have now removed some teeth from the wallower so the engine can be turned independently from the hurst. We now turn the engine through a quarter turn and back on each visit.

In the last report I covered the visit by about 80 Anglia Ruskin Students taking the final year module *Conversion and Adaption of Buildings*. The students produced a portfolio and a presentation, working in groups. Two of us, along with representatives, were invited to assess the presentations with members of staff and MDC representatives. After the examination board had met we were given the fourteen portfolios.

There were some good ideas and much information for us to utilise in preparing our vision for the Mill. There was not, as expected, a ready-made document, however.

We completed the volunteers' car park in mid-May 2016. This has enabled the parking of up to five cars without blocking the access to Beeleigh Falls House. Once the car park was completed we moved on to building a temporary cover for the six mill stones we were given by ECC. The stones are now out of the rain with air circulation.

The Committee set its thoughts on the stone floor and concluded that its repair is a priority. We are delighted that Joe Bispham, a building conservation expert, was willing to work with us on this both as a consultant and contractor. Following a meeting with Joe and an MDC conservation officer, the project has the go ahead. All we need now is the funds to carry it out which we estimate to be between £20,000 and £25,000. Liz Morgan has been working hard on the fundraising side of the project. Although we have made a start, substantially more money is needed. We hope that we can soon begin the project and that the money flows in!

We are grateful to Maldon Archaeological and Historical Group (MAHG) for the gift of a 2.4 by 3.6m shed for which we now have planning permission and it will be erected soon. The intention is to use it to store the re-usable timber for the floor. Under MAHG supervision we carried out an archaeological dig where the shed will be sited and the report is on p. 30.

If you listened to BBC Essex on Sunday morning, 5th March, you may have heard that Beeleigh Mill was one of the locations of the Essex Radio Quest. The visit was fleeting because we were holding the last clue and the team were running out of time! Both Graham Thorne and I were able, however, to tell the listeners something of the Mill. See picture.

Another job we have just completed is a timber hand rail around the shaft pit to the northern water wheel house.

Robert, our model maker, now has the model Beeleigh engine working under steam – what a joy to watch. The video was posted on the web for a short duration and is now no longer available.

We look forward to seeing many visitors on National Mills Open Day on Sunday 14th May and Heritage Weekend, Saturday and Sunday 9th and 10th September when Beeleigh will be open to the public. We will also open specially for pre- arranged groups.

I hope you all have a good summer and autumn and look forward to meeting you when you visit the Mill.

Request to members: please photograph for us good display ideas when visiting mills, museums or other heritage sites.

James Wentworth – news update

by James Morgan

In the second edition of the Newsletter, we published the first part of the history of James Wentworth and Sons, the manufacturer of the Beeleigh beam engine. In that article we described the first record of James Wentworth, when he appeared as a witness at an Old Bailey trial in 1814. The court record describes him as being employed by a George Hall of Dartford. We have never found any trace of a George Hall at Dartford, but another Hall, John Hall, was known in Dartford and his company made beam engines very like the Beeleigh machine. In fact, a John Hall engine can be seen on the ground floor of the Science Museum.

In 2016, member Mrs Jo Blaney researched newspaper records for reports of the 1814 trial. She found the following entries:
Windsor & Eton Express 30th Oct. 1814 , which reports that James Wentworth of Wandsworth was 'servant to Mr Halle of Dartford, millwright'. This piece was repeated in the *Kentish Gazette 4th November, 1814* , but Hall was used instead of Halle.

T*he Public Ledger and Daily Advertiser 31 Oct.1814* which also reported that James Wentworth was 'servant to Mr Hall, a millwright at Dartford', but in another paragraph it describes how the £10 note was

sent to James Wentford by R. Clarke who was 'in the employment of J. Hall at Dartford'.

A very detailed account appears in the *Kentish Weekly Post or Canterbury Journal , 1st November 1814:*

'Saturday – CHARLES HUSKE ALLEN was indicted for stealing a 10 ℓ. note out of a letter from Dartford, in Kent, to James Wentworth, at Wandsworth, in Surrey, the property of John Hall, on the 20th July.

Richard Clarke was in the employ of John Hall, of Dartford; and on the 19th July he enclosed a 10 ℓ. note in a letter to Mr James Wentworth, at Wandsworth. The note was numbered 5325, May 21, 1814. Witness took the letter to the Post Office. – Henry Heron was Post-master at Dartford on 19th July last. He forwarded all the letters to London that day. Charles Reid receives the mails at the Post Office as they come from the country. On the 19th July the Dartford Mail came safe. The prisoner opened that mail, as being clerk at the table where he had to sort his portion of letters. – Chas. Piesse was at the same table with the prisoner on the 19th July. They opened the bags, and assisted in sorting letters from the country, to be delivered to another part of the country. Witness handed over all letters regularly that morning. James Wentworth, servant to Mr. Hall, who is millwright at Dartford, proved that he received no letter from Hall, containing a remittance of 10 ℓ. Although he expected one on the 20th of July.- Robert Nash, shopman to Mr. Elsworth, linen draper, in Bishopsgate-street, proved that the prisoner came to his master's shop on the 20th of July, and bought six handkerchiefs, which he paid for with a 10 ℓ. Note. Prisoner wrote on it, "C. Wilbraham, Trafalgar-place, City-road'. Peter Dowling, a clerk in the office of Mr Parkin, Solicitor to the Post-Office, had enquired diligently at Trafalgar-place, but found no such person as C. Wilbraham living there, nor any trace of him.- The note was then read, and found to correspond in date and number with that which Mr. Clarke enclosed at Dartford, in a letter addressed to Jas. Wentworth. – Mr. Parkin received the note in question from one of the inspectors of the Bank. – The prisoner said nothing in his defence, and

a number of respectable persons gave him excellent character.- The Jury, without hesitation, found him Guilty – *Death.* He is a good looking youth, between the 15 and 16 years of age.

These newspaper reports confirm, what was suspected, that James Wentworth had started his career as a millwright working for John Hall and Sons of Dartford.

John Hall served his apprenticeship in the paper making industry in Hampshire. He moved to Dartford, where he had family, in 1785, and set himself up as a self-employed smith. Dartford was also a centre of the paper making industry at that time. He prospered and five or six years later needed larger premises and bought land in Dartford for his business. He married in 1791 and had six sons and four daughters. Two of his sons, John and Edward, joined their father in the firm and before 1836 they were describing their business as 'Engineers, Steam Engine Manufacturers and Millwrights, Iron and Brass Founders'. John Hall senior died in 1836 and John junior and Edward changed the name of the firm to J&E Hall Ltd, which still exists today. In the book 'Halls of Dartford 1785-1985' the author Harry Miller writes:

'The firm's beam engines and boilers were exported to many European countries and as far afield as India and China. John Hall had apprenticed his sons John and Edward to the business and later took them into partnership. After Edward had served his time in the works, he was sent to Paris in 1817, at the age of eighteen, visited Spain, Belgium, Russia and other countries and remained the firm's overseas representative until called home when his father died in 1836. Edward was inventor as well as salesman. One of his inventions, according to Everard Hesketh in his history of J. & E. Hall, was a metallic packing for steam pistons to replace the gasket packing used at that time. One of his best-selling lines was the firm's 'Elephant' boiler, a horizontal cylinder with three narrower cylinders parallel to and below it and connected to it by what Hesketh called 'necks'. Seeming as it did to stand on short thick leg, it resembled a docked and headless

hippopotamus rather than an elephant. One of Hall's mechanics called Powell, who had been sent to France to install engines, started his own works in Rouen and manufactured so many Elephant boilers that they came to be known even in England as the French boiler. 'The Elephant Boiler', states one of Hall's advertising leaflets, 'is never afflicted with collapses.' Customers endorsed the claim and one of them, in a letter to *The Engineer* magazine in 1883, said, 'We have three which have been at work continually for 50, 40 and 41 years respectively, and the amount of repairs they have required has been trifling. They are very sturdy steamers and we have never had any sort of accident with them. We have lately had them insured and the company's inspector has passed them — even the one that has been at work for over 50 years'.

In view of the connection between James Wentworth and John Hall, the boiler at Beeleigh may well have been made by J&E Hall and bought in by Wentworth's when they supplied the engine to Beeleigh in 1845. A current Director of J&E Hall International, who supplied the following, certainly believes it is a Hall boiler.

John Hall 1764 - 1836

Halls of Dartford

1785-1836

'Elephant boiler', Beeleigh Mill

An Engine for *Brahminy*

The Last Elephant Boiler at Beeleigh Mill - Maldon

by Robert Walker, abridged by Lawrence Tattersall

Introduction

BMRG member and regular Tuesday-afternoon-at-the-Mill volunteer Rob Walker has built a steam engine from scratch and its detailed construction has been described in a series of articles in *Model Engineer.* With Robert's kind permission I have reduced the 36 pages of the original to a more manageable size for our Newsletter whilst still embracing the relevance to our own steam engine. I will let Robert tell his own story:

Project origins

A family wedding in China brought my brother-in-law and me together and later, in the bar, he announced that he wanted to build a wooden, steam powered launch. I of course, as an engineer, said I could make the engine! The small fly in the ointment was that the boat was to be built by my brother-in-law in Cairns, Australia and I live in Essex, England!

The design

First area of research was to determine, for a 15 foot boat, the size of the engine required which turned out to be a bore of 2.5" and stroke of 2.5". I found a number of suppliers of castings but they seemed expensive so my idea was to use stock material; also I had to avoid welded parts as I do not have welding equipment – the last time I did some serious welding I was a first year apprentice and that was a very long time ago. To be honest I have not done much machining since the second year of my apprenticeship, but I do have a Myford 254S lathe and a Myford vertical milling machine. As I could not find published plans for the type of engine I wanted I decided to design my own engine and the result is Fig. 1.

Construction begins

The first parts I made were the piston and piston rod. This is a fairly straightforward turning (Fig 2) and parting off job but the diameter is important to give the correct clearance and it has been designed to still have clearance when operating on steam. The key feature is clearance for the piston rings– they need to have approximately 0.001" *(one thou' to us oldies, LT)* clearance in their groove so that they are free to rotate but not to allow steam to pass behind the rings, (Fig 3).

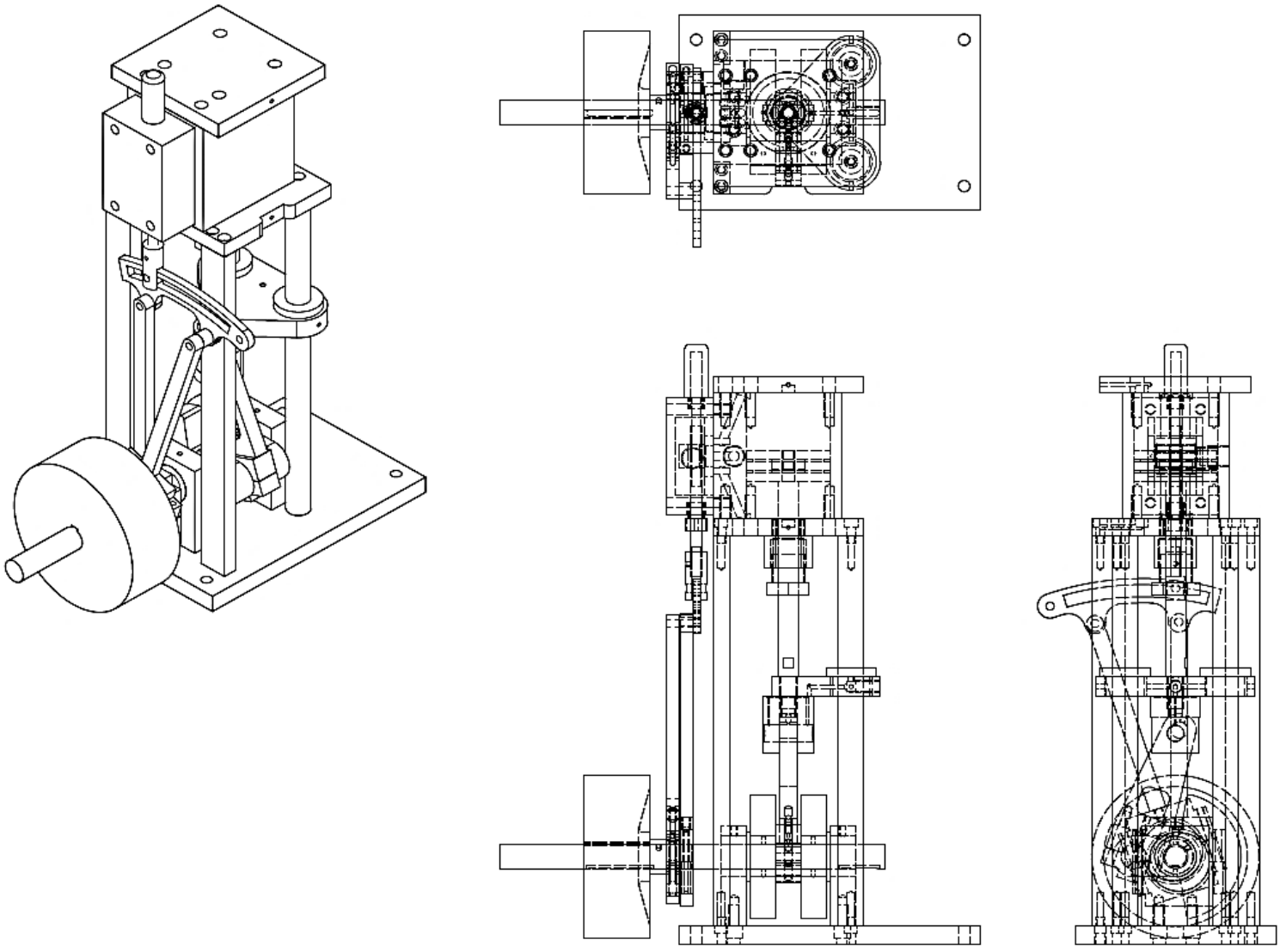


Fig. 1 *General arrangement drawing without nuts, bolts and cotter pins*

Fig. 2

Fig. 3.

The next part I made was the cylinder block,. Again most operations were relatively straight forward and difficulties normally revolved around the equipment available. For example, I could not mill all the faces to size as I did not have a milling vice big enough so two faces were turned on the lathe.

As my mill does not have power feed, I bored the cylinder bore to size on the lathe taking care not to machine the chuck jaws! (Fig 4).

The valve face stud holes and slots were then machined on the mill. The block was then set up at 22° as shown in Fig 5 to machine the steam transfer port.

Fig. 4.

Fig. 5

The valve chest and slide valve were next. It is well known that it is the steam pressure that holds the slide valve face on the cylinder block and the normal way to design a valve chest is with a cover so that the valve position can be adjusted. In my opinion this is another possible leak path for steam. I have eliminated the cover by putting the adjustment at the bottom of the rod, (Fig 6).

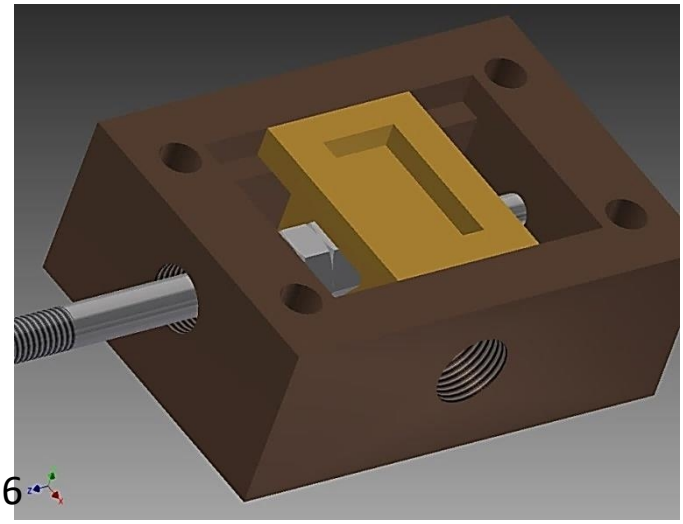


Fig. 6

There followed the fabrication of the bearings, crankshaft, eccentric, rods with guide bushes, connecting rod, big end bearing, gudgeon pin block, flywheel, oilers, reverser link with follower and ancillary items.

When discussing the manufacture of the reverser with a friend, I said I was going to chain drill and file it to shape (Fig 7). He said that is an apprentice's job and he would cut it out on the plasma cutter. And he did – it is one of only two "cheats" in the entire manufacturing process. Plasma cutting is not as clean and accurate as laser cutting so there was still some hand finishing to make the follower slide freely the entire length of the groove (*so not such a big cheat after all! – LT*).

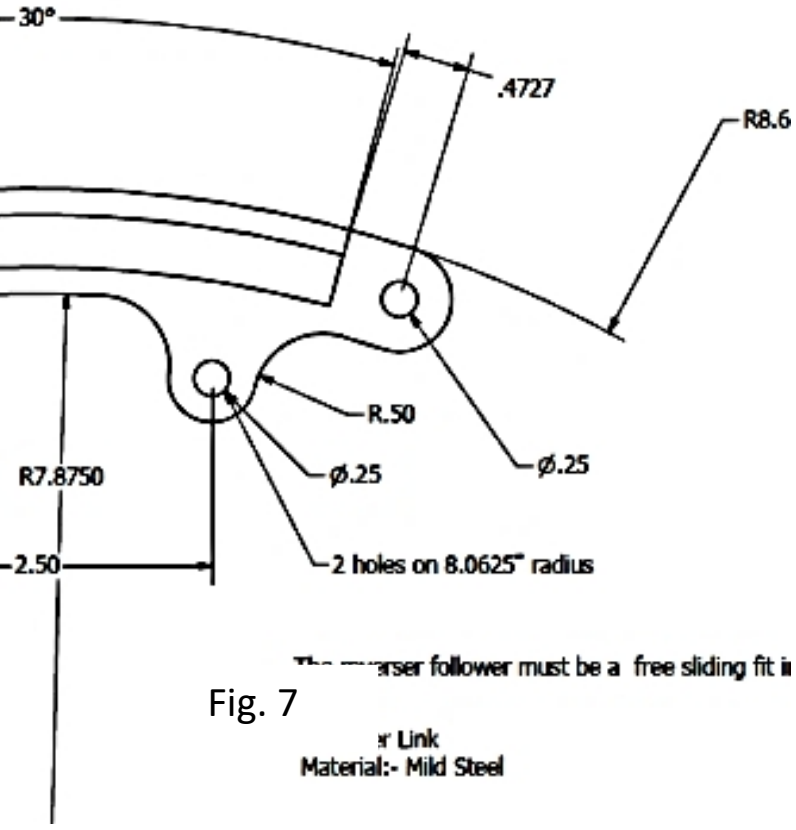


Fig. 7

Assembly and testing

Assembly was done in stages with the first test of the cylinder block assembly operating on compressed air with manual control of the valve (Fig. 8). Assembly continued until the timing needed setting.

Fig. 8

I continued to check that the engine rotated freely as the valve can set to over travel and lock the engine. With the engine plugged into the compressed air supply I set the reverser in mid position – the engine should be stationary and free to rotate by turning the flywheel. Checks for air leaks from the exhaust port and the valve necessitated lapping the valve surface on the cylinder block. The engine in this position was trying to turn and this was adjusted out by changing the valve rod setting.

To see the engine running on compressed air whilst being demonstrated to first year engineering students at Anglia Ruskin University go to: https://www.youtube.com/watch?v=O3EAa3avHwA

Shipping

I had to come up with a novel way of shipping the completed engine to Cairns – I used my late father-in-law's ex-RAF issue, pre 2nd World War tin trunk. I greased the engine thoroughly and bolted it to aluminium (for lightness) bearers I had bolted to the sides of the trunk. The engine was prevented from rotating by cable ties. Everything, including the separate pumps, was surrounded with bubble wrap. The trunk was shipped by air and arrived in Cairns about 5 days later.

Engine and *Brahminy* are united

My brother-in-law reassembled the engine, made sure everything was free to rotate, cleaned and painted it – red for the moving parts and black for the remaining (Fig. 9). Wood cladding was then attached to the cylinder block (wood and wood products cannot be imported into Australia). It was then test run on compressed air, successfully. The boiler and chimney were made in Australia.

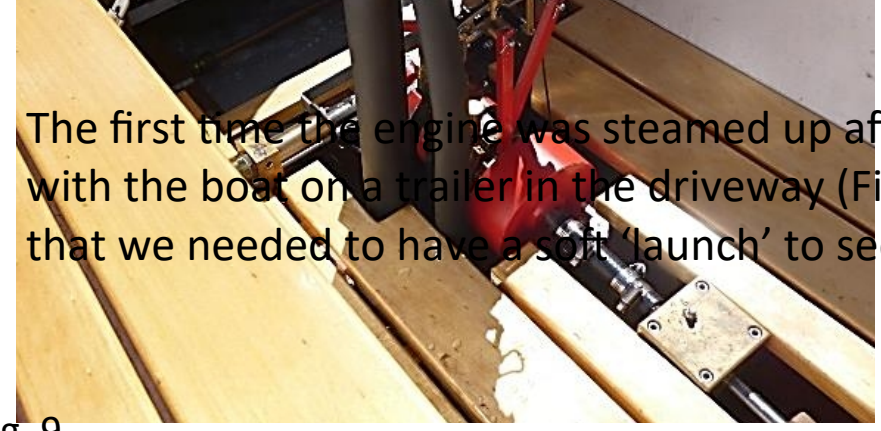


Fig. 9

The first time the engine was steamed up after its arrival in Cairns was with the boat on a trailer in the driveway (Fig. 10). But then we decided that we needed to have a soft 'launch' to see how she sat in the water.

This we did on Lake Tinaroo – *Brahminy* sat well in the water, held two adults safely with a good trim, so then we did a short test run. We had already lit the fire on the trailer, got steam up to 110psi and she moved beautifully – and then stopped! On inspection, we realised a safety coupling had broken.

Fig. 10

The first of the following links shows the maiden voyage on Lake Tinaroo in Queensland of the 15 ft steam launch *Brahminy* and the second the annual picnic of the Wooden Boat Association of Cairns a week later.

https://youtu.be/xzIt2ZALq2U https://youtu.be/TfhqR2ixWgQ

As can be seen from the videos, the launch was successfully driven at a speed (estimated by a qualified Marine Engineer) of about 6 knots. The pressure of the safety valve was set at only 110 psi and the engine was still driving the boat at about 4 knots when the pressure had dropped to about 30 psi. I estimate that for use on lakes or canals this engine would be suitable for launches up to 18 feet in length at 150 psi. The boiler is a *Blackstaff* water tube boiler and the fuel we were using was a mixture of wood off-cuts, left over from building the boat, and charcoal brickets.

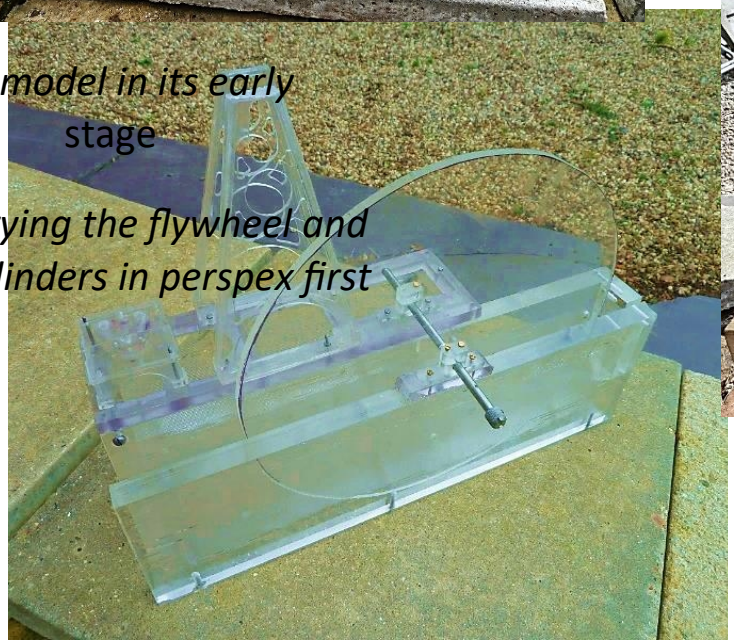
I started making the engine at the end of December 2013 and its maiden voyage was in June 2016 – but I did have a lot of distractions, including volunteering on the Romney, Hythe & Dymchurch Railway and being a volunteer for Remap – custom-made equipment for disabled people (http://www.remap.org.uk)

The First Steaming! (Robert on the left)

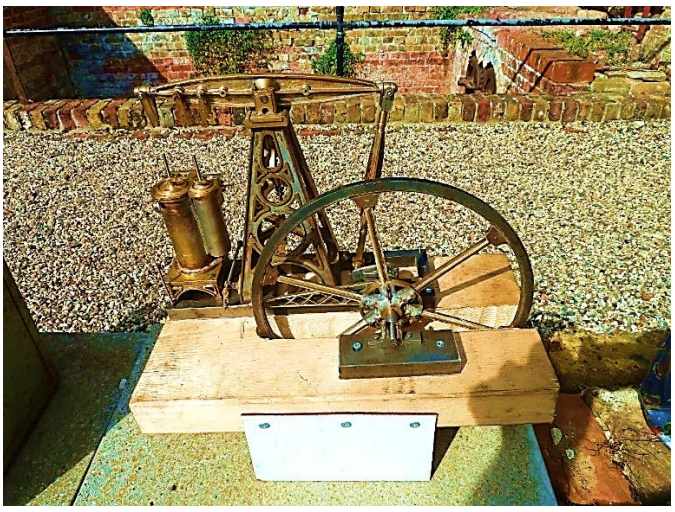
Robert Bailey's model of the Beeleigh Mill Beam Engine Update

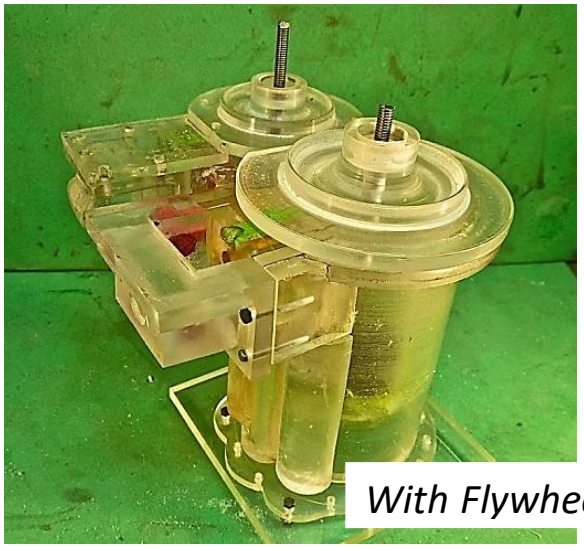
By Lawrence Tattersall

The model in its early stage

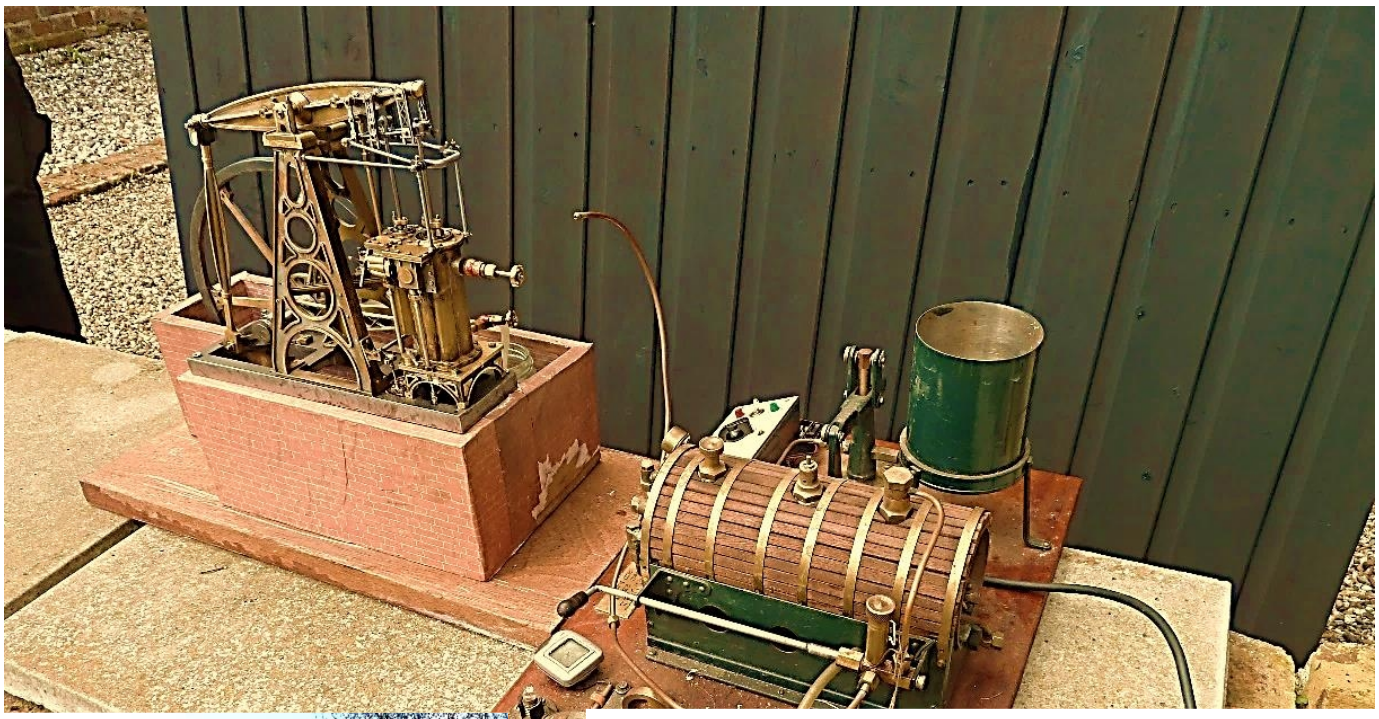


Trying the flywheel and cylinders in perspex first





With Flywheel and cylinders



*Watched by the film crew of the **Southend Amateur Photographic Group** who are making a film of our restoration of Beeleigh Mill*

On our regular Tuesday afternoon work session of 25th April 2017 Robert brought the model, now working, along with a little electric steam generator to demonstrate the beam engine operating.

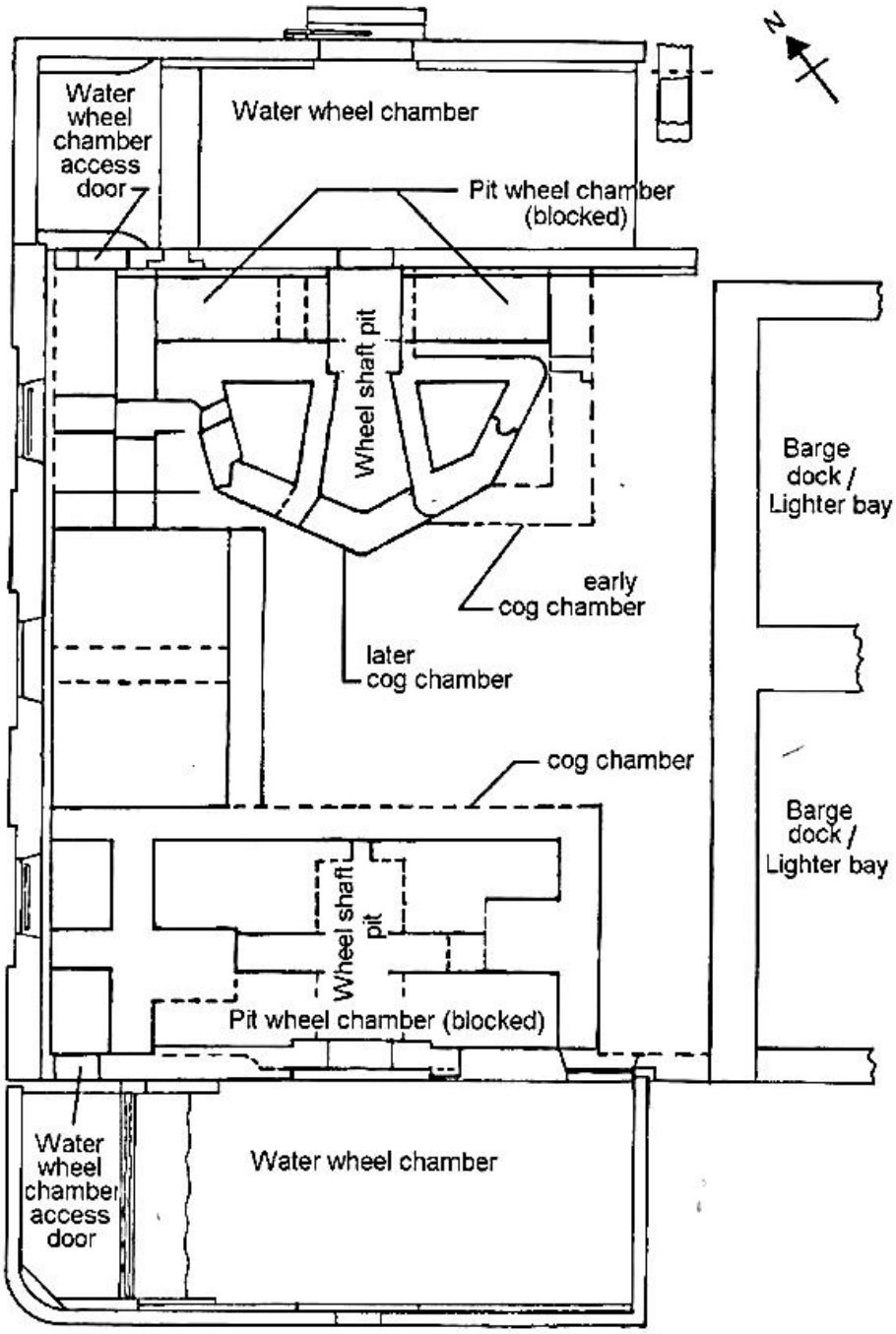
Beeleigh Water Mill – thoughts on its layout

by James Morgan

Introduction

Beeleigh Mill was redeveloped from 1795 to 1797 and equippe two water wheels sets of millstones. All was lost in the fire of 1875 and the remains were left as ruins until the 1960s when Essex and Suffolk Water acquired the Mill, Beeleigh Falls House and the adjacent land.

This paper considers the little documentary and remaining physical evidence at the Mill and attempts to recreate on paper the layout of the Mill stones in the watermill before the fire.



Sketch showing foundations of watermill excavated by M.A.G.

Fig.1: *Layout of foundations from MAHG book*

The walls around the watermill were capped in the 1960s and the north water wheel house was roofed over in the 1990s to create a suitable roost for bats. Apart from these changes which affected the upper walls and north wheel house, there is no evidence of any other changes to the Mill walls.

Fig. 2*: Foundations in south part of Mill*

The north wheel house, nearest the steam mill, has an arched opening below current ground level, which, it is presumed, was where the output shaft from the water wheel was located. In front of this arched opening is a trench, rectangular near the waterwheel house, becoming rhombus-shaped further out.

The south water wheel house has a semi-circular opening at current ground level with a bearing base plate set into the wall and another smaller semi-circular opening, again with a bearing base plate, half way up the wall.

In 1994 Maldon Archaeological and Heritage Group (MAHG) took on responsibility for opening the Mill to the public for the English Heritage Open weekends in September and, as a consequence, undertook work at the Mill to clear the weeds etc.. They also did an archaeological survey and, from that, produced a scale drawing which shows the internal brick wall foundations, which were visible on the surface at that time. This drawing, Fig. 1, is reproduced in the first edition of the booklet 'History of Beeleigh Mill'. There is also a photocopy of the drawing in the MAHG Beeleigh Mill file in their office. This has been used to reproduce the wall lay- out in a new scale drawing.

A Possible Watermill Layout

Turning first to the South waterwheel: merging the outline of the south area of the watermill, from the MAHG drawing Fig. 1 with the Mill layout from the BMRG 3D model, gives the layout in Fig. 2. The thin lines are the wall footings identified by MAHG.

Generally, 4ft diameter millstones are designed to be run at about 120 rpm. This reduces as the millstone diameter increases. A book on

millwrighting of the period suggests that the speed of rotation of a 4ft 6in diameter stone should be about 110 rpm. Based on an internet search, in general milling practice the fastest a water wheel was designed to turn was 10 rpm. In fact at two existing mills in England the water wheel turns at around 6 rpm (Letheringsett Mill, Norfolk and Lurgashall Mill, Sussex). Milling practice also suggests that the vertical shaft would turn at least three times the speed of the water wheel and the gearing ratios quoted at the sites above support this assertion.

At the end of the 18th century, mill design was still conservative. Innovations consisted of the introduction of bevel gears and the use of iron for components. The millwrights who rebuilt Beeleigh Mill for Mr Dunkin, the mill owner, would have followed custom and practice, so it is reasonable to expect that the pit wheel was located in the chamber nearest the water wheel and the vertical shaft was supported by a bearing located next to the chamber.

A search of Newspaper records found that Joseph Ward, the miller who bought the Mill in 1835, placed the following advert in the Chelmsford Chronicle on 26th March 1840: 'TO BE SOLD BY AUCTION by order of **Mr Ward** who is making extensive alterations. Machinery of one side of Beeleigh Mill comprising a water wheel 24 feet diameter, 8 feet wide with 80 iron floats; water-wheel with cast iron cap; 16 ft. pit-wheel with iron segments; 5 bridge trees with carriages, lighter-irons, etc; 3 feet-10 iron wallower nuts with suspending irons etc; 11 feet 9 geared spur-wheel, pair 4 feet, 6 French stones, 25 feet upright oak shaft, with plumber, block etc; geared crown-wheel, riggers, jumpers, stiff irons, driving irons, dressing machines and various other machinery, wrought & cast iron, brass etc; 2 28-inch cast iron knees, timber jack, beer engine, pony etc.'

In the Notice of Sale for the Mill in 1835 the 'East' waterwheel is described as 22ft diameter by 7ft 8in wide with iron floats and the 'West' waterwheel is described as 23ft diameter by 8ft wide with wood floats. Referring to the plan of the Mill in the introduction, the most easterly wheel is to the north and the westerly wheel is to the south.

We may conclude that the waterwheel being offered for sale was the south wheel as its size is the closest to that described in the advert.

The advert, therefore, gives us the sizes of the pit wheel, wallower, great spur wheel and the stones. The ratio between the pit wheel and the wallower was 1:4.17. The mill stones were 4ft 6in diameter so their speed of rotation should have been about 110 rpm. Spur wheels and stone nuts were often made with 2" pitch teeth and were often 2ft or less in diameter. At 1ft 11in diameter the stone nut would have had 36 teeth at 2" pitch and at this size of stone nut the water wheel would have had to turn at 4.7 rpm. Applying this size of stone nut with the wall layout above, we arrive at the Hurst layout in Fig 3.

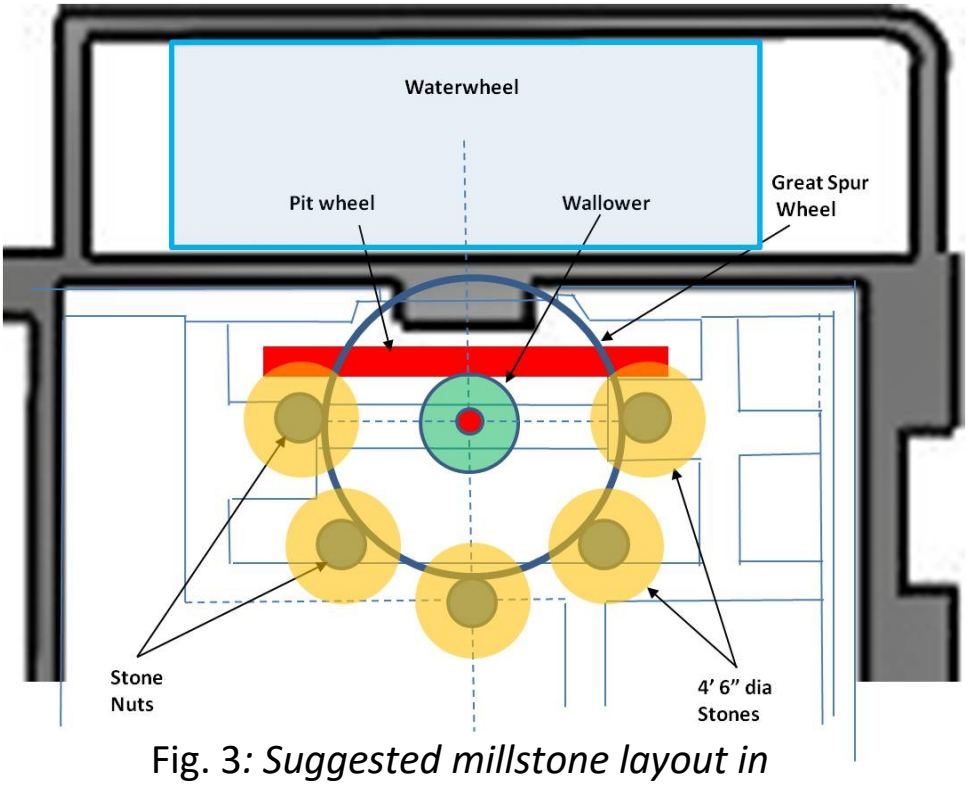


Fig. 3*: Suggested millstone layout in 1797 for south wheel*

The size of spur wheel described in the advert creates a conflict with the mill wall. However, the mill wall has a recess at high level and the spur wheel would have fitted nicely in that recess (Figs. 4 & 5).

This layout would have been valid, thereabouts, until 1840, when it appears Joseph Ward took the south waterwheel out of service and sold it. It should be remembered that we have to date no documentary evidence that he successfully sold it. We do know, however, that the engine and steam mill were installed in 1845. Maybe the water flow was proving to be too unreliable for Mr Ward's business needs and the steam mill was installed to overcome this.

Fig. 4*:*

South wall of watermill

Fig. **5***: Recess in south wall*

Turning now to the north water wheel: over the years there have been some modifications to the walls at the north of the watermill. The layout identified by MAHG is shown in Fig. 6. Ignoring more recent changes, what would have been the pit wheel chamber is of a very similar size to the south one. It also seems reasonable to presume that the equipment originally installed on the north wheel in 1797 would have been the same as the south.

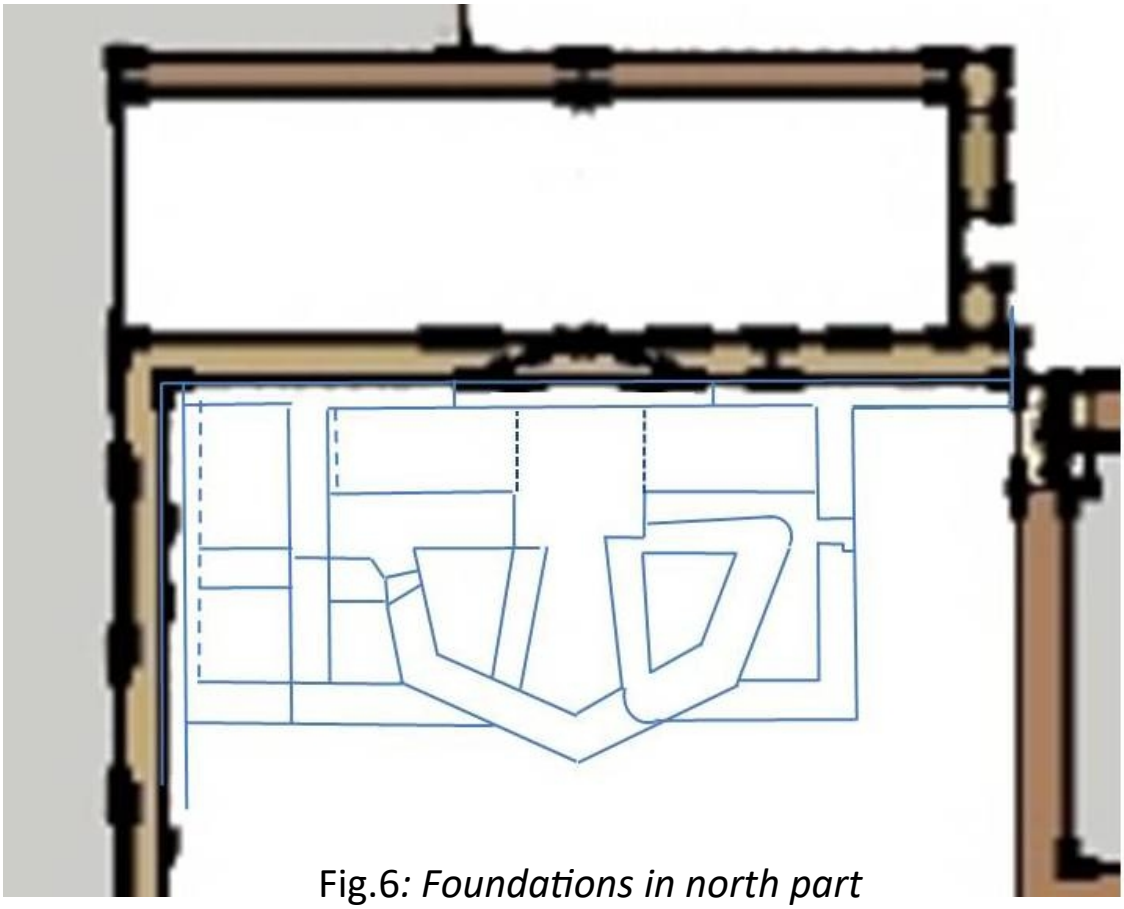


Fig.6*: Foundations in north part of watermill*

Applying this logic to the north Hurst gives the layout in fig 7.

The two Hurst layouts contain a total of ten pairs of stones as described in the Notice of Sale from 1835. In 1875, when the watermill burnt down, however, it had, according to the newspaper report of the time, twelve sets of stones in the watermill and five in the steam mill.

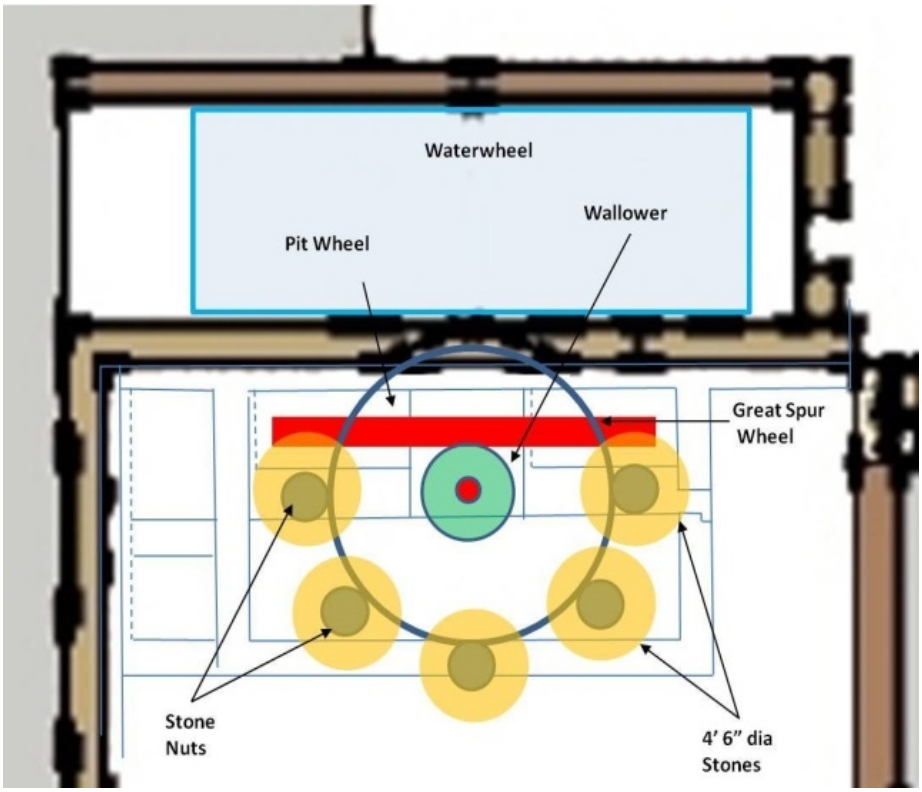


Fig. 7*: Suggested millstone layout for north wheel*

The Science Museum archive in Swindon holds a 'Wentworth Dimensions Book' which had been donated by Young's when they owned the Ram Brewery in Wandsworth, where the only other remaining Wentworth engines are located. The Group visited the archive in 2011 and viewed the book. It is actually a sort of sales record and in it there is an entry detailing a 20ft waterwheel with pit wheel, wallower, spur wheel and various other gears under the heading 'Mr Ward Beeleigh'. The page also records in the same handwriting 'Ward of Beeleigh Mill Nov 18th 1850 said at Mark Lane .....' so it is likely that these two records were written at the same time. It also seems likely that this record is of the sale to Henry Ward – now the miller at Beeleigh, having taken over from his father in 1846 – of a new water wheel for the south chamber.

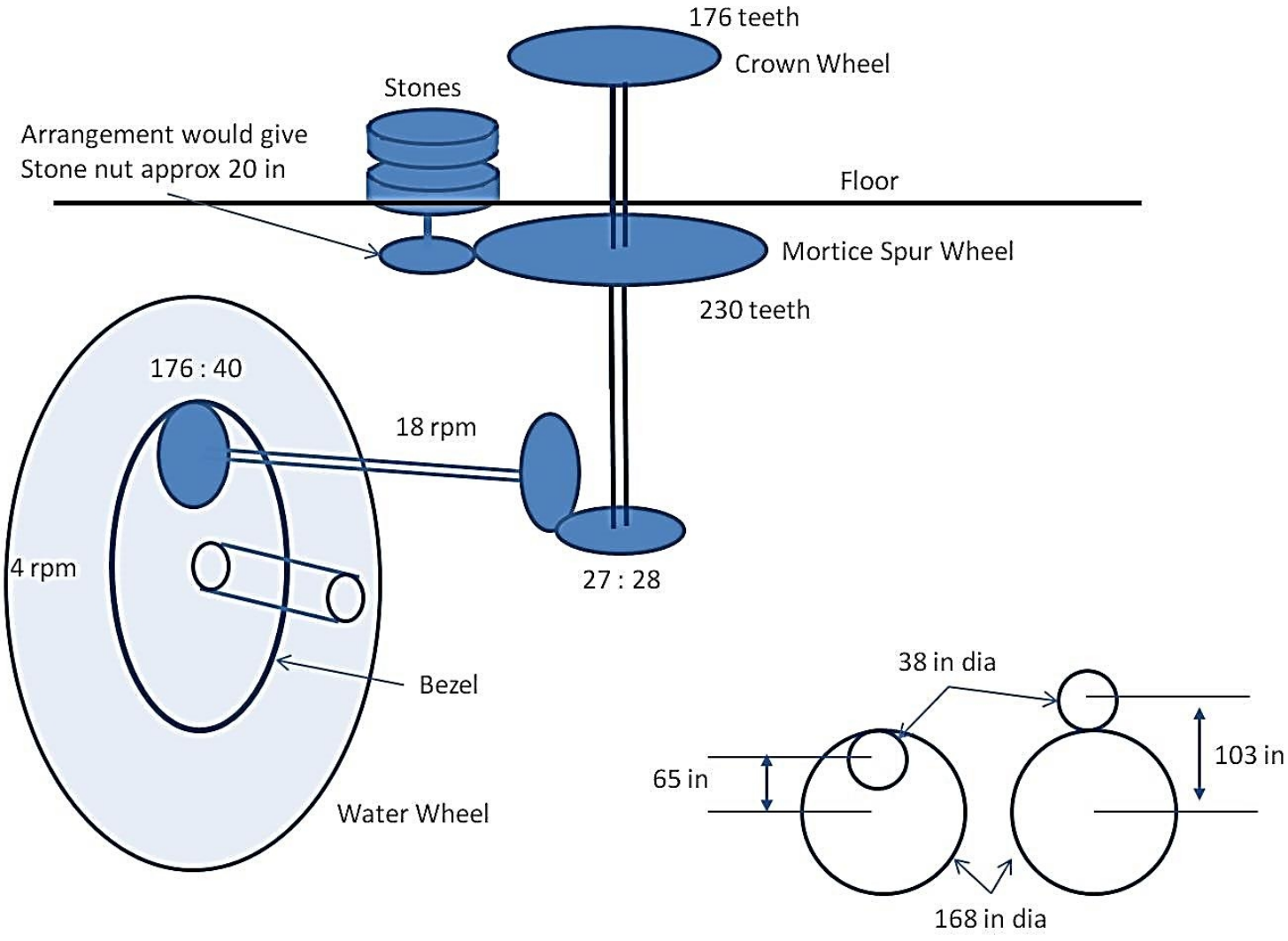


Fig. 8*: Bezel or Ring gear drive system*

Fig. 9*: Two openings in the south wall of mill*

The entry is in copper plate writing and difficult to read. Graham Robinson, ex-Millwright, has helped with its interpretation and has suggested that the equipment described in the Dimensions Book would be consistent with a bezel gear arrangement as shown in Fig. 8.

Bezel or ring gear arrangements can be either internal or external.

The diameters of the ring gear and pinion are given in the Dimensions Book and, therefore, in the arrangement above, the distance between the output shaft to the Hurst and the centre of the water wheel would be 65in if the gear was internal and 103in if it were external. (see Fig. 8).

The south wall of the watermill has an opening for the water wheel central shaft and another above it. (see Fig. 9).

The distance between the estimated position of the water wheel centre and the output shaft is 65in. This supports the proposition that the younger Mr Ward did buy a new south wheel and gearing from Wentworths in around 1850.

Applying the information from the Dimensions Book to the south area of the watermill gives the layout in Fig. 10.

This use of a ring gear allows the spur wheel to be placed away from the mill wall and for seven sets of stones to be positioned around it, achieving the total number of stone sets described in the reports of the fire in 1875.

Possible water mill stone floor layout

In order to understand what the water mill stone floor might have looked like, in part at least, it is necessary to combine the various layouts suggested above. This gives us two arrangements, one covering the period 1797 to 1840, and the other from circa 1850 to 1875. These arrangements are shown below.

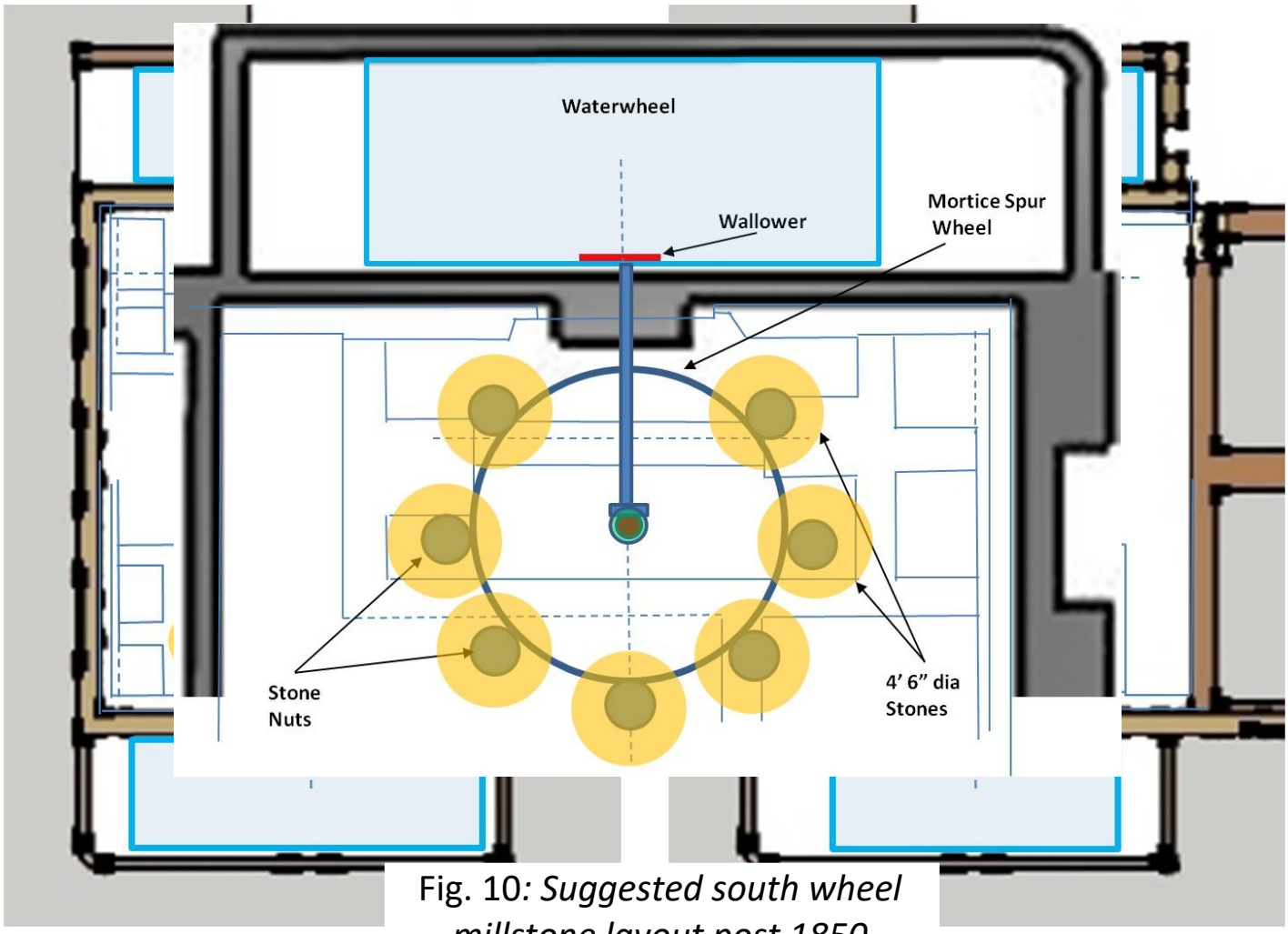


Fig. 10*: Suggested south wheel millstone layout post 1850*

Fig. 11: *Water mill layout to 1840*

Fig. 12*: Water mill layout from 1850*

Conclusion

We may never know what the Mill layout actually looked like. By using what limited information is available, however, and by looking at what is left on the site itself we can make an educated guess. I hope that the above analysis is a reasonable attempt to do this, but it can only be speculation and others may have a different interpretation.

Excavation Below Beeleigh Mill Granary

By Lawrence Tattersall

Following on from James Morgan's article in our Newsletter 6 – '*Some thoughts on the layout of Beeleigh Mill'* - James thought that there might have been a wall across the granary in the very area we proposed to put the shed that MAHG had kindly donated to us. We therefore decided we should investigate whilst we were waiting for the planning permission to erect the shed.

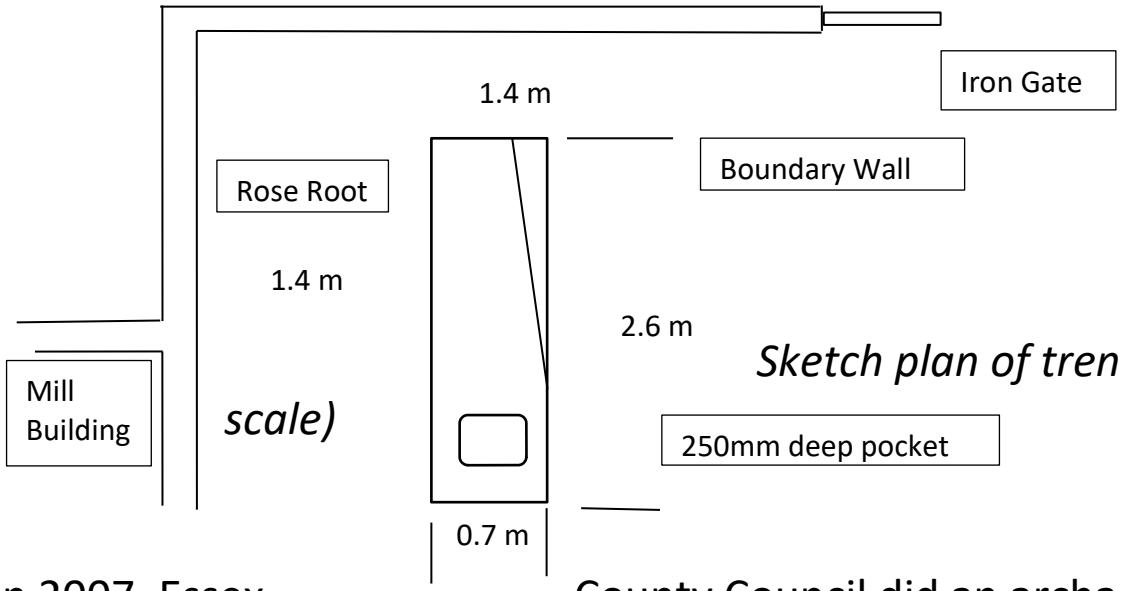
The dig was led by MAHG member Brian Riley who guided our Tuesday afternoon volunteers in the task. Our thanks go to Brian for his help and his report on the dig.

A trench was chosen to intercept the possible wall line, but the digging soon came across a very large rose tree root so a curve was introduced in the line of the trench to avoid disturbing the root. (See plan).

Our Chairman was a key navvy in the excavation!

Unfortunately we found no evidence of a wall but there was an interesting burnt layer running continuously along and across the trench.

This layer was most noticeable as a layer of black soot but it also contained hardened grey and white fragments. Its thickness varied up to about 8 mm. We assume that this layer is a result of the fire in 1875 and is a useful record of the levels at that time.



Sketch plan of trench (not to scale)

In 2007, Essex County Council did an archaeological evaluation of the Auxilliers Unit hideout under the granary floor of the Mill. That too found a layer of similar burnt residue but of a thickness 50 times that of the new trench layer, i.e. some 400 mm thick. There is no explanation for this apparent discrepancy.

Below the burnt layer there was a hard layer which proved to be very thin and a deeper pocket was easily excavated.

Rose root

The dig revealed very mixed conditions which no doubt reflected the various activities in the yard over the decades following the Mill's operation.

Hard layer

We understand from previous residents in Beeleigh Falls House that the area was once a vegetable or flower garden!

Mixed in with the soil was a high proportion of building demolition material. This included bricks, broken bricks, rubble, mortar, broken roof slate and the like. Some pieces of smooth thick slate as is used in a billiard table were also found.

Picture showing the pocket dug beneath the hard layer

Clearly we didn't disturb the rose tree now in full bloom!

Students from Anglia Ruskin University, led by Alan Coday, visiting our Mill in preparation for their Project Module on ***Conversion and Adaption of Buildings.***
(see Chairman's Report)

Stone Floor Project Report
April 2017

by James Morgan

The stone floor is the upper floor of the Steam Mill, where the millstones were located. It is a complex structure with four layers of planks, some bolted together. At some time in the past the original roof failed, wet rot and wood worm took hold and eventually part of the floor collapsed, leaving a large hole.

To repair the floor we plan to dismantle the timbers piece by piece, decide which can be reused, buy new timber for those planks that cannot be reused, get contractors to replace/repair the three main beams that have deteriorated and then re-lay the timbers in the same pattern as they were. The repair is primarily required to conserve the building, but, once repaired, it will make it possible to allow visitors on

to the floor where we can have information boards, photographs etc.. Ultimately we hope to install a set of stones there for demonstration purposes.

The project started in November last year when we engaged a Historical Building Conservation Consultant, Joe Bispham, to advise us on the project. In early December, a number of the volunteers met at the Mill with Joe, James Owden, the Millwright, and Tim Howson, one of Maldon District Council's Conservation Officers, when it was agreed we could dismantle the floor to expose the beams without making a listed building planning application. In January this year we agreed the method we would use with the Millwright and asked the owners of the site, Essex and Suffolk Water, for their permission. E&SW gave their permission in March on condition that we were able to confirm we would not disturb any bat roosts by doing the project. We approached Essex Ecology Services Ltd to help us on this issue. They visited the Mill early in April and have been able to give us the green light.

Meanwhile, we have been fund raising. The Committee allocated £1,140 to the project from reserves. Members have donated a further £1,000, following the appeal sent out by e-mail at the end of January and we have been awarded £5,000 by the Essex Heritage Trust once we start the actual work. Liz Morgan, our fund raising coordinator, has also made applications to the Association for Industrial Archaeology for a restoration grant and to the Society for the Protection of Ancient Buildings, but we do not know if these have been successful. Our preliminary estimate suggests, worst case, the project will cost over £20,000 and require around 450 volunteer hours. We won't know how much of the timber we can reuse until we start to dismantle the existing timbers (or what is left of them).

If you wish to make a donation towards this project please send cheques made out to 'BMRG' to Mr Lawrence Tattersall, BMRG Treasurer, 73 Hoynors, Danbury, CM3 4RL or, if online, to the BMRG bank a/c No.03369676; sort code 20-19-95, adding 'stone floor' as the reference. Any donation, no matter how small, will be very much appreciated.

Miller or Murdler – Some Interesting Etymology!

By Gay Tattersall

Googling idly for possible interesting material about 19th Century millers, I came across a long and fascinating (to me) list of Victorian* occupations. Under letter 'M' was, of course, 'Miller', but that wasn't the only word…….

There were, for instance, 'Multurer', 'Millow' , 'Muner' and 'Murdler' as synonyms for 'Miller', while a specific corn miller could be called a 'Melder'. A 'Mealman' was a dealer in corn or flour and females were surprisingly also allowed to be millers as 'Milleresses'.

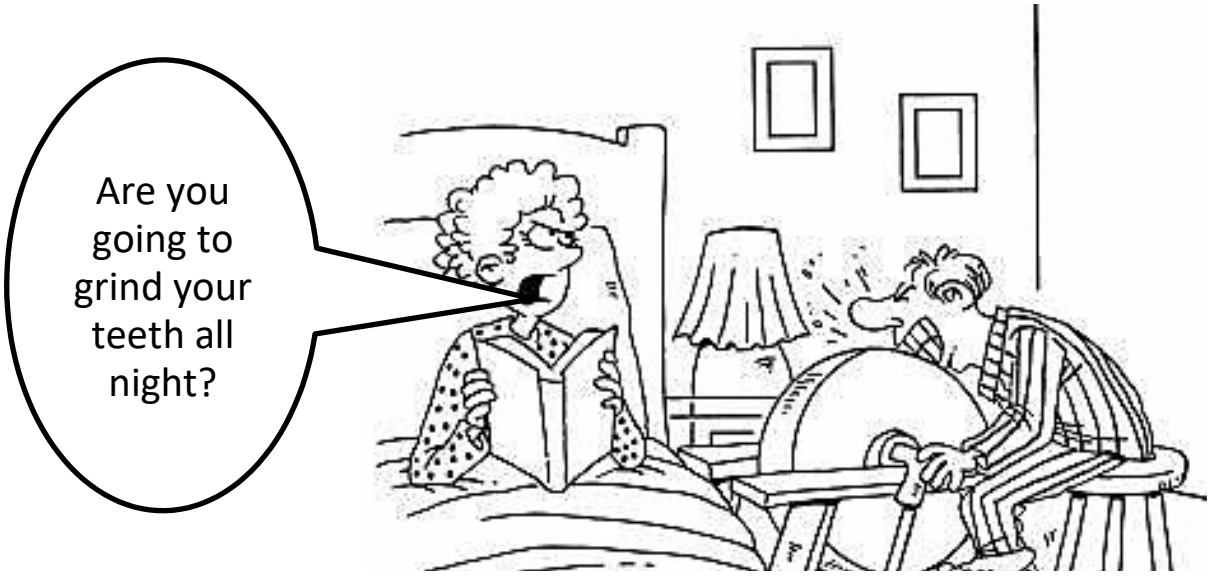
A 'Molitor' – a German surname – was also in use as a miller, but the high-sounding term 'Millstone Inspector' was an ironic name for a 'vagrant or gentleman of the road'! Someone who sharpened millstones was known as a 'Millpeck'.

The most interesting name for a miller was, however, 'Moldenarius' or 'Molendenarius', which doesn't look to have any connection with a miller. But, with a little more 'research', I discovered the following: 'Michael, son of Stephen Molendenarius' of Eastwood (not the Nottinghamshire Eastwood) near Todmorden in West Yorkshire was Much the Miller's son in the legends of Robin Hood. So, at least there was a miller in the frame as a person's name, but how was the long-winded word 'Molendenarius' connected with a miller in the first place?

I had a vague feeling that the 'denarius' bit was to do with money and indeed it is as it meant 'containing ten' in Latin. In my old school Latin dictionary, 'denarius nummus' or just 'denarius' alone was also a Roman silver coin – the one that gave us the 'd' in pounds, shillings and pence! So, I was getting closer since a miller was notorious for being fat and well-fed and – hence – having money. According to Chaucer's unflattering portrait in his 'Prologue to The Canterbury Tales', the Miller had a 'thombe of gold, pardee (by God)', which was a veiled

reference to a miller's possibly dodgy practice of pressing his thumb on the scales to increase the amount of grain to be milled and thus the price he charged. In Chaucer's The Reeve's Tale, the Miller is a cheat who robs the Manciple (steward) and fills up sacks of grain half with bran instead of flour. His name is Simpkin (simpleton!). Maybe not so simple, but he does get his comeuppance in The Reeve's Tale.
See next year's Newsletter!

So, if the denarius bit of Molendenarius can be connected to millers via the idea of money, albeit dishonestly obtained, what about the 'molen' bit? This gets really interesting: a 'mola' in Latin is a millstone and the plural 'molae' means a mill, with a transferred meaning of 'grits, coarse meal or flour'. Adjectivally, 'molaris' means 'of a mill, to do with grinding' and also, as a noun, 'a millstone'. Which is where we get our MOLARS! for grinding! Phew!



Other interesting 'M' words I found were: 'Muggler' for 'Pigman'; 'Mudlark' for a 'Sewer Cleaner'; 'Mango' for 'Slave Dealer'! and a 'Maderer' who sold garlic. A 'Master Lumper' was a contractor of labourers at a cheap rate of pay; hence the expression 'on the lump'!.....

*Not all the words in the list had their origins in Victorian times.