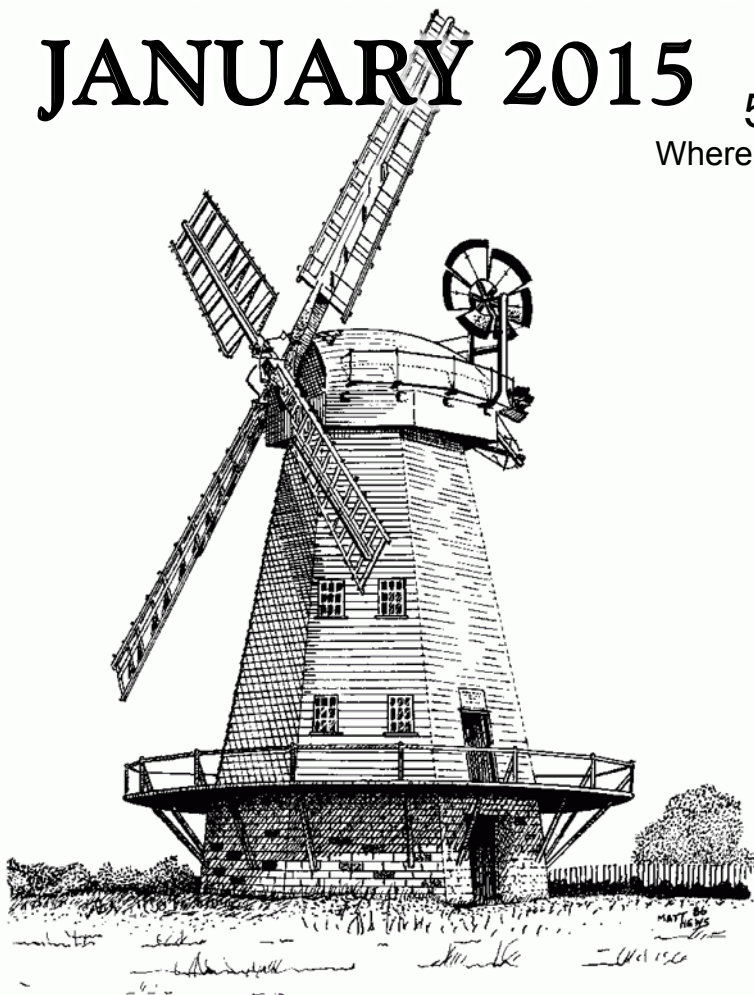


UPMINSTER WINDMILL NEWS JANUARY 2015

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From the Chairman

Following the success of our application to Heritage Lottery Fund, work is proceeding to bring the restoration plans to fruition. An architect has been appointed to manage the construction work. Planning consent had already been obtained for the new Education and Training Centre. The architect will now finalise those plans and assist with the appointment of a building contractor. The building work will probably start in the summer and be completed early in 2016. A millwrighting consultant will be appointed in the Spring to ensure we are ready to appoint one or more millwrights for the restoration work, which we hope to start as soon as the new building is available.

In the meantime, the archaeology of the site has continued. We have been quite staggered to discover such extensive remains of the former steam mill. Cliff's article in this Newsletter provides more details. We will be exploring ways of preserving this site, if possible as an open space to ensure public enjoyment.

Our partnership with the National Mills Archive is also bearing fruit. Their web-based photographic archive is expected to be launched in the Spring, enabling ready access to thousands of mill related items. The partnership links our two websites. We have lodged 100 images, including recently restored photographs and some of our spectacular computer graphical images produced by Cliff and Jonathan Green. If all goes to plan, our next Newsletter will provide a link to this material. DC.

Quiz Night

The windmills annual quiz night will be held on Sat 21st Feb, starting at 7.30pm, in the Main Hall, St Laurence Church - price £6 per person, bring you own food and drink. All profits go towards the upkeep of our mill. This is a popular event, and tables are going fast, so please book early to avoid disappointment.

Archaeology at the Windmill.

A Happy New Year from the Archaeology Team

The Archaeology continues throughout the winter, except for a two week break over the festive season. Our attention is mainly concentrated on the Steam Mill. To date we have uncovered the boiler room showing brickset flues and chimney base, with an external flue running from the brickset to the chimney. The brickset used refractory bricks especially imported for its construction. Three quarters of the Coal Place (we had to halt the excavations there as we would not have been able to peg down the tarpaulin) has been excavated, including the area where the face of the boiler sat, and the run off pipe, which was still in situ. We also established that the eastern end of the north gable wall of the coal place, was thicker than the rest. We think this was to strengthen the North West corner of the boiler house gable wall, where the boiler face protruded.

We have also uncovered the area where the steam engine was located, finding the anchor bolts for the engine mounting, and various mouldings and marks on the engine plinth with which we can now place the engine accurately in its original location. We



Engine plinth, and crankshaft pits



Brickset under flues



External Exhaust Flue to Chimney



Grinding Room Pit



Coal Place



Grinding Room showing both sides of the room

have also established the crankshaft pits and the iron bearing frame for the flywheel bearing. It was also discovered that the flywheel was part recessed in the western wall of engine house. This was to allow alignment of the gearing mechanism in the grinding room.

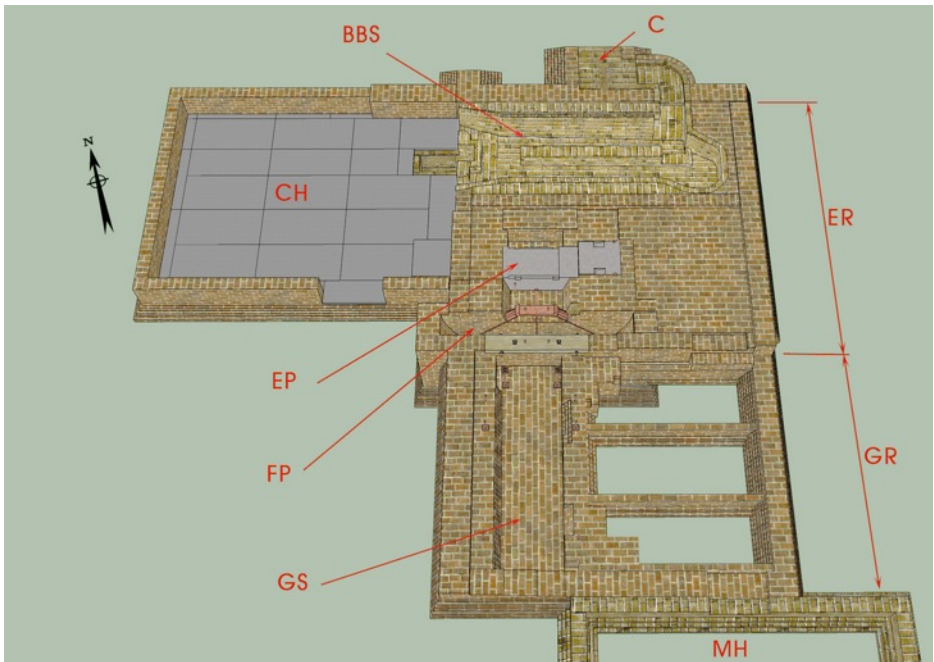
We have uncovered the grinding room, this building was in two parts. Part one (the Western side) consisted of a brick built pit which housed the machinery to turn the two sets of mill stones. This pit revealed several recesses along its length on both sides, which allowed for the correct alignment of the machinery to operate in the confined space. Part two (the Eastern side) was a timber floored area used to access the stones and hoppers. Some of the wooden floor was still in situ although burnt. There was an air vent built in to the dividing wall at ground level between the grinding room pit and the wooden floored area. We also established that the steam mill butted up to the meal house, which is more evidence that the meal house was built at the same time as the Windmill.

The archaeology team have now been able to accurately measure all the features excavated, and plot heights as well as positions of the various features, so that they can be faithfully be reproduced on maps and reconstructions. We are now continuing to clean up these areas and looking for the pig courts, so that we can tie these buildings together and establish the line of the road from the windmill round to the stables. We still have the Granary, Coal Office, Original Stables, Cart Shed and the remainder of the Meal Room to excavate, which we hope to have completed by the spring.

Paul Sainsbury & the Archaeology Team.

Steam Mill

Two and a half years ago a project was started to assess the steam mill that once worked in tandem with the windmill, and attempt to make a computer reconstruction. Despite the scant number of documents and photographs available, a look-alike was produced as a 3D model, which many of you will now have seen. A large amount of supposition and calculated guesswork were used in making that first model, but now that a full archaeological investigation of the site has reached an advanced stage, a re-assessment and re-modelling has been possible to a much higher order of accuracy than previously.



Footings as revealed by the archaeology.

C Chimney; BBS Boiler brick setting; CH Coal House; ER Engine Room;
GR Grinding Room; MH Meal House; EP Engine plinth; FP Flywheel pit;
GS Gear sump

Last season's work on the steam mill also brought an unexpected outcome. Right from commencement of the dig it became evident the remains were more extensive than first thought, and in appraising these it proved fortuitous that the ISSSES (International

Static Steam Engine Society – the gurus on industrial steam plants and their history) were consulted for advice. They immediately declared that what we have at Upminster is of National importance, in that remains of a Bell Crank engine site, especially one with supporting post 1900's photographs, is extremely rare.

The following is a brief summary of the steam mill and site, taking into account the knowledge gained recently.

Boiler. The original boiler type is not known, but most probability was of a Wagon Top design. Such boilers had a cross sectional shape that was rectangular in the lower half and semi-circular at the top. Their fire was underneath and had flues to redirect the exhaust gasses around the sides for additional heating. In 1911 this was replaced with a Cornish style boiler from the Colchester firm of Davey Paxman, and the ISSSES have traced John Arkell Abraham's order for this in the Paxman archive. It was 14ft long and 4ft in diameter, and would have cost around £80 (£7400 today adjusting for the value of the £ over the period, but not taking account of the relative market value at each date).



The new boiler shell shortly after delivery to the mill in July 1911. This old photograph has been colour tinted to make the boiler distinguishable from its surroundings. Behind the boiler is the Abrahams' horse and cart for coal deliveries.

Unlike a Wagon top boiler, the Cornish boiler had a fire tube passing through its centre, so the old brick setting in which the original boiler was mounted had to be rebuilt, providing a chamber at the exhaust end of the fire tube to direct the hot gasses into a system of two under flues; the entire assembly then being enclosed in a brick box.



Left: The boiler shell sat above flues built into the floor.
 Right: The fire tube and sides of the shell were enclosed to direct hot exhaust gasses into the under flues to give added heating.



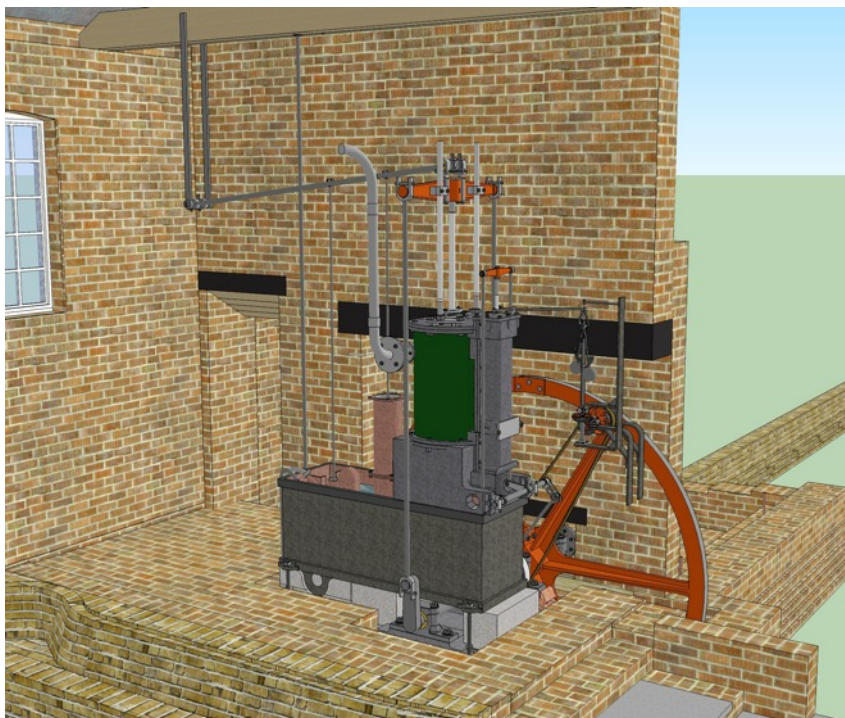
Left: Outer brick enclosure.
 Right: The face of the boiler protruded into the Coal House for stoking. Two iron trapdoors provided access to the under flues for cleaning.

Engine. This was an extensively modified Boulton and Watt (B&W), Bell Crank engine, the alterations effectively converting it into a tank mounted table engine, with grasshopper beam to drive its pumps. It had a piston of approximately 16ins dia. with a stroke of 2ft, and was designed to run at 40 rpm, producing 6 brake horsepower. The flywheel was 10ft dia. and would have weighed in at just over 1 ton.

B&W kept records of every engine they built, with details of the date, purchaser, and site where it was to be installed. The ISSES have carried out extensive searches in the B&W archive and other references, but have not yet found the origin of the Upminster engine. This implies that the engine was bought second or third hand as a private transaction, not through B&W, although some of the components needed for the modification would have come from the B&W works. In addition many of the details of the engine mounting and drive train were in keeping with B&W practice, indicating that an experienced engineer was in charge of the installation; if not employed by B&W, trained by them.

Every B&W engine was slightly different, but many had features in common. The archaeology has revealed a number of important details associated with the engine's mounting: marks left in the concrete and brickwork; size and height of the engine plinth; anchor bolts, and an iron flywheel bearing stand. By comparing these to drawings supplied by the Science Museum and the B&W archive of similar engines, it has been possible to gauge the exact size of the engine's cistern, and determine the alignment of the crankshaft. Establishing the exact centre line of the crankshaft has been vital, as that dictated the layout and dimensions within the grinding room, and in turn how the various mechanisms were assembled.

In general the engine was set far closer to the side wall of the mill than first expected, with the flywheel running partly in a slot formed in the mill's west wall. This westward placement meant that all the equipment in the grinding room, including the stones, had to be lined up in a narrow zone down one side of the room.



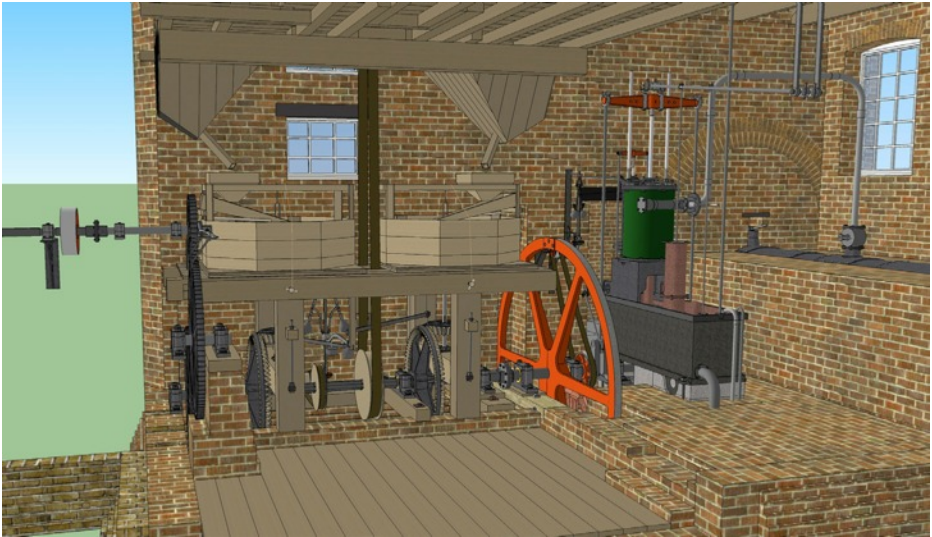
The engine set on a raised plinth of brick and concrete with the crankshaft passing under the cold water cistern.

Such an engine would have cost £450 new in 1811, which converts to £33,900 at the present value of the £, but like the boiler, this does not take account of relative market values.

Grinding Room. The arrangement of crown wheels, stone nuts, and sack hoist was known previously from an old photograph, but the archaeology has shown their exact positions, and clarified details of the gear sump housing the drive system. The number of governors and steelyards used for the tentering gear to control the stones were, however, uncertain, as the photo did not have sufficient clarity, but with the aid of accurate site dimensions and 3D drawing, the problem has now been solved. There was one governor, three steelyards, and two counter weights, which exactly match the fragmentary details shown in the photo.

The stone floor and bin floor remain largely as previously modelled,

simply with some adjusts to take account of the building's dimensions found by the archaeology. The one exception has been the jockey wheel to operate the sack hoist: new dimensions and a reappraisal of the photograph has shown this was not on the bin floor, but suspended like a pendulum under the stone floor near to the governor. After correcting this error in the model, it now matches vague shapes shown in the old photo.

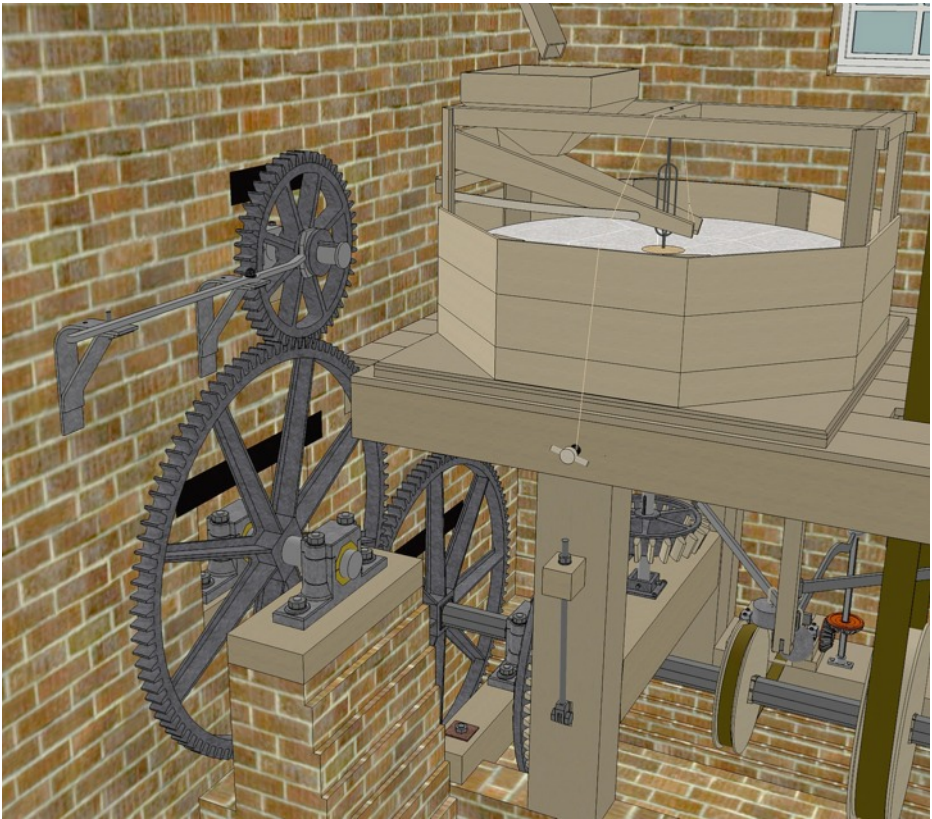


In the image above, the south gable wall, and the internal dividing wall between the engine and grinding rooms have been omitted.

Auxiliary drive shaft. A drive shaft to transfer power from the steam engine into the windmill to assist in running machines like the bolter and sack hoist, was a fact recorded more than sixty years ago, but the records do not say how it was coupled to the engine. The current archaeology has provided the essential evidence to show how this was done: a clearance slot in the side of the grinding room gear sump at its southern end, to accommodate a large gearwheel fitted to the end of the primary drive shaft, being the clue.

In the archive there is a photograph taken in the late 50's, after the steam mill interior had been dismantled, that shows two cast

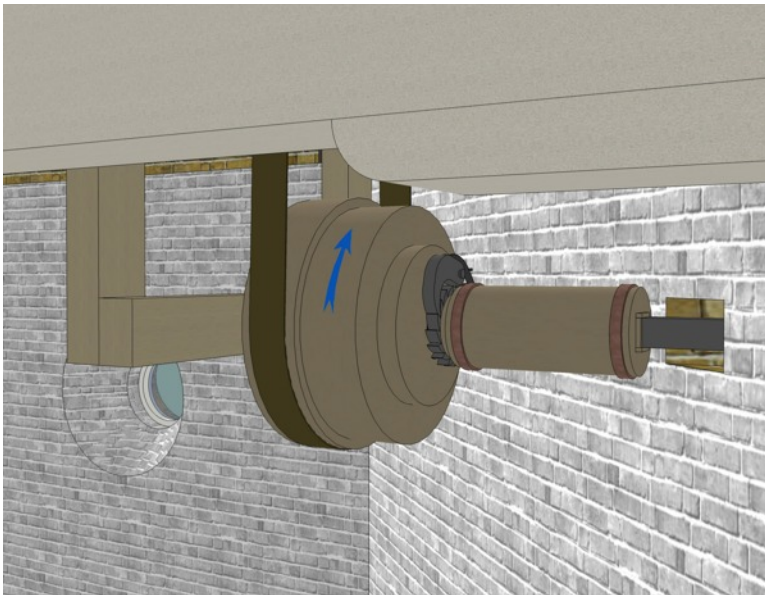
iron plain gears leaning against a wall, each about 4ft dia. Where they were used, if at all, was not known. With the discovery by the archaeologists of the clearance slot, their purpose has become obvious, especially as one has a square hole in its hub that matches the primary drive shaft. By drawing the gears to scale and superimposing them on the 3D model, a working arrangement can easily be constructed for transferring the drive to a shaft running along the top of the wall in the meal house, and into the windmill. A third small gear was required to reverse the direction of rotation, and it is possible that such a gear is the one that has survived and is currently stored in the windmill.



Three gear combination. The smaller top gear is connected to the auxiliary shaft passing through the south gable wall and down the length of the Meal House, and into the windmill. The mechanism can be disengaged by means of a lever that slides the small gear out of mesh.

At the end of the auxiliary shaft where it terminated in the base of the windmill, was a novel freewheel device. This was described in 1948 by an engineer, Waring Sholl, who stated that if both wind and steam power were running together, 'a competition might arise as to who would be first'. The windmill's mechanisms were fragile compare to those of the steam mill, so if the windmill ran faster than the engine, its mechanism could be damaged by trying to drive the steam mill.

The freewheel device comprised a wooden belt pulley, and a ratchet and pawl. The ratchet was driven by the auxiliary shaft, and the pawl was attached to the wooden pulley. When the engine ran faster than the windmill, the pawl remained engaged and turned the pulley, but when the windmill was the faster of the two, the pawl disengaged, allowing the pulley to spin freely on its axle and run ahead.



3D model. The model of the steam mill will continue to be updated as the archaeology and research provide more information. A new animation is also being prepared. Please contact me if you would like a full copy of the Sketchup model.

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Cliff Featherston

Flint Knapping Lecture

On the 22nd November 2014 a flint knapping lecture and demonstration was held at the Old Chapel in St Mary's Lane Upminster. This was a joint venture between The Friends of the Old Chapel and the Upminster Windmill Archaeology Group. The lecture was given by a post graduate from Southampton University called James Dilley. James gave a couple of excellent talks on flint knapping whilst demonstrating the art and skill of flint knapping, and producing a couple of flint axes. James covered flint tool usage and knapping skills through the various periods in time from the Palaeolithic through Mesolithic to the Neolithic period. James also had a range of flint and antler tools and weapons on display, with some items for sale. The session ended with a wonderful buffet lunch. The turnout was good with around 36 people attending, who all enjoyed the demonstration and the lunch. More information about James Dilley's work and skills can be found on his website www.ancientcraft.co.uk Thanks go to Gemma and the Friends of the Old Chapel for their hospitality and help in arranging this event.

Paul Sainsbury

Open Days 2015

Please note these will be the final open days of the Mill until the refurbishment is completed.

April 4, 5 & 18,19

May 2, 3 & 9, 10 & 30

June 6, 7 & 20, 21

July 4, 5 & 18, 19

Aug 1, 2 & 15, 16

Sept 5, 6 & 19, 20

Special Events - Mill open from 12 noon

June 7 Craft Fair

June 21 Art Exhibition in Old Chapel. We are planning to show restored photographs, computer graphics etc of the Mill. More details in April Newsletter

July 5 Classic Cars Display

Our Newsletter

Back numbers of the Newsletter are available on the Mill Website.

This Newsletter is available electronically, saving printing and postage costs. If you would like to receive the Newsletter electronically, please let Ian Ross know by emailing him at membership@upminsterwindmill.co.uk.

The next Newsletter will be published in April. Contributions are welcome and should be sent to the Editor by early April..