

Mill of Benholm, Kincardineshire, Aberdeenshire



Gazetteer: Part 2: Meal Mill Lower Floor

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Prepared by Sonya Linskaill RIAS RIBA
slinskaill@btinternet.com

Introduction

This Gazetteer forms part of a series for the assets at the Mill of Benholm including:

Part 1: Mill Buildings

Part 2: Meal Mill Lower Floor

Part 3: Meal Mill Upper Floor & External Items

Part 4: Water Mill Infrastructure

The Gazetteer should also be read in conjunction with the Mill of Benholm Conservation Plan.

The gazetteer lists items of interest recorded during site visits in May to September 2023. The items are listed with a short description and images. Comments on their authenticity, significance and other observations are made. Terminology for mill infrastructure and parts of the milling operations has been taken from *The Mill of Benholm, The Story of a Scottish Meal Mill*, by Lesley Miller, published by Kincardine & Deeside District Council in 1996 when the mill was reopened as a visitor centre; additional information presumed from the same source is available on interpretation panels on site. Information recorded in the Scottish Industrial Archaeology Survey in 1983 (Canmore, MS/500/35/83) has been included where relevant as a comparison to the current position. A drawn record of the meal mill floor plans and machinery from the 1983 survey can be found in Appendix 1 of the Conservation Plan.

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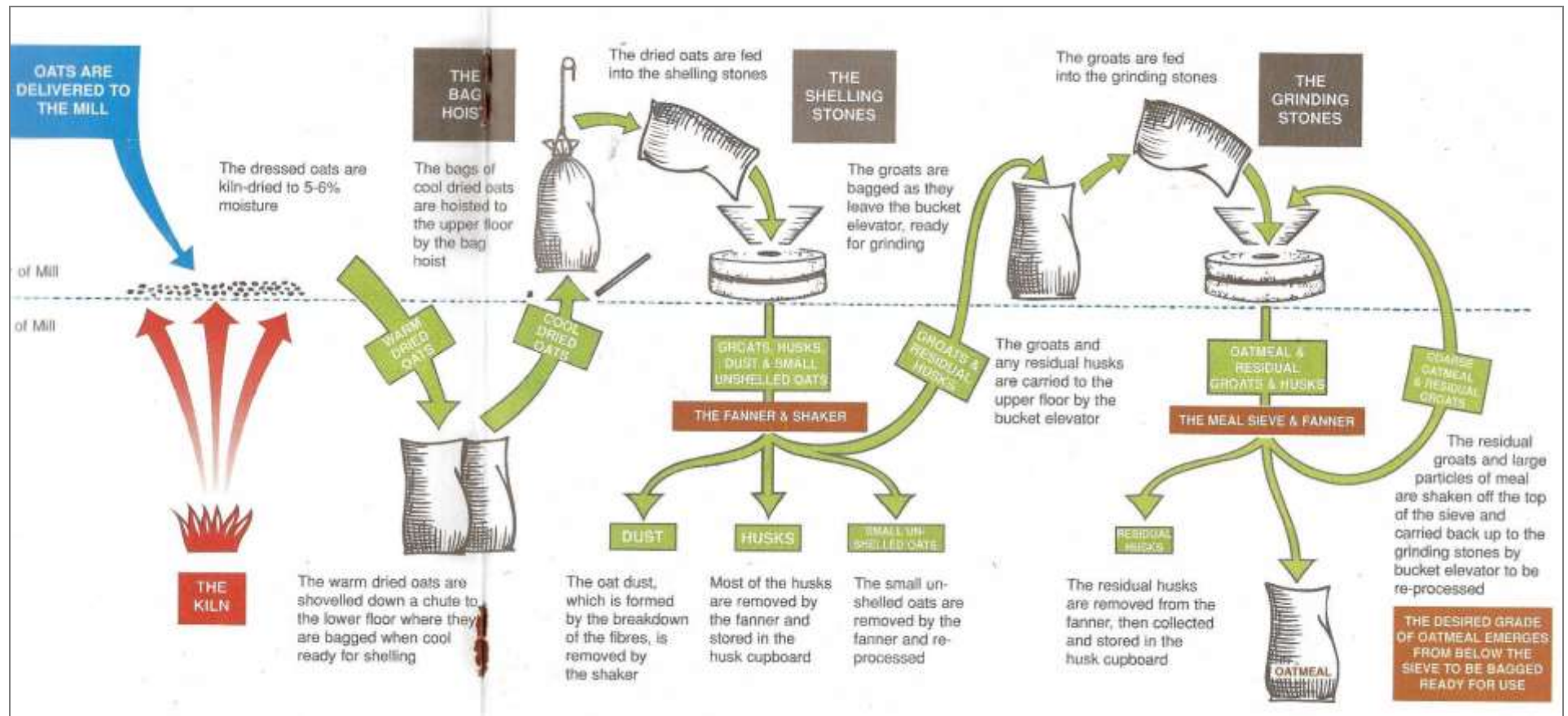


Diagram in Miller (1996, 17) on the various processes of shelling, separating and milling at Benholm. © Aberdeenshire Council

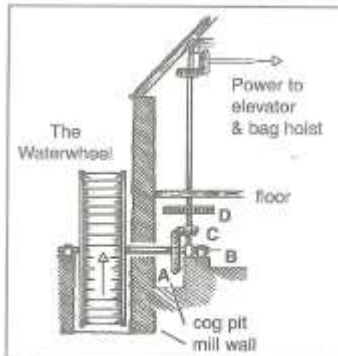
The Transmission of Power

Although the arrangement and complexity of the gears vary from mill to mill, the basic principle of transmitting power from the waterwheel via the axle to the pit wheel

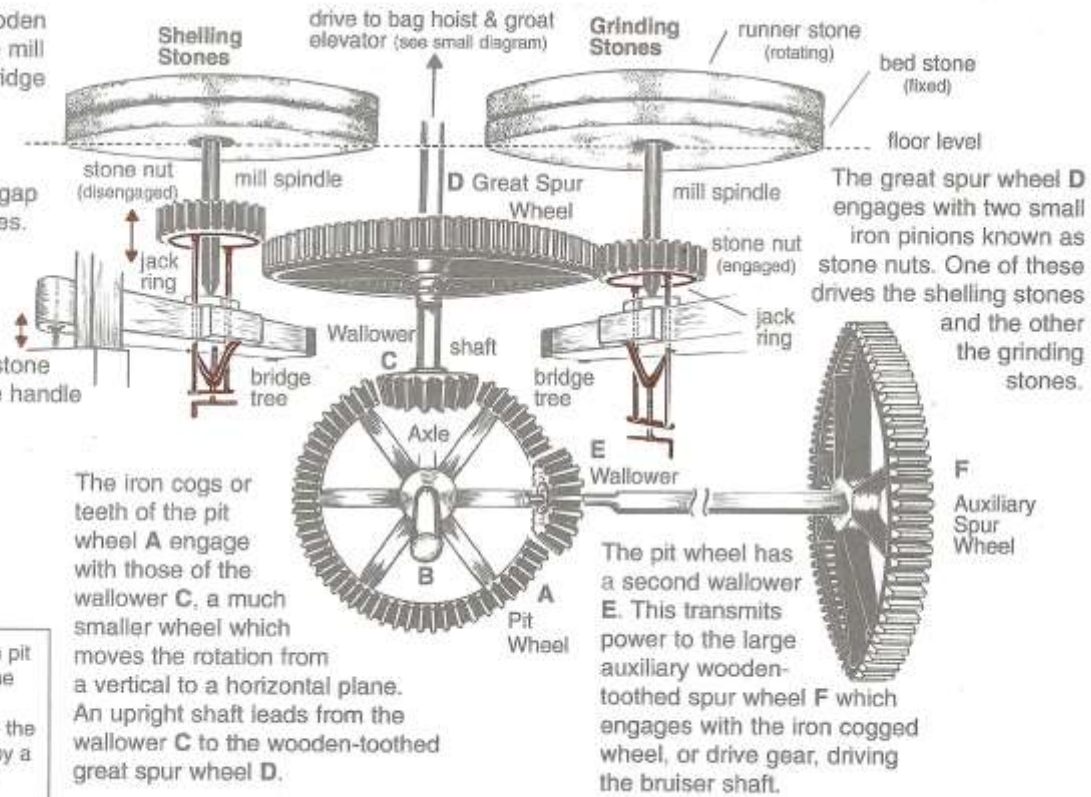
and hence through a series of cogged wheels, or gears, to the mill machinery is fundamental to all mills. The gears at Benholm are illustrated below.

The bridge trees are the massive wooden cross beams which are pivoted at the mill wall. The bearings mounted on the bridge trees carry shafts, known as mill spindles, which support the runner stones. By raising or lowering the bridge trees the miller can adjust the gap between the runner and the bed stones.

The jack rings allow the miller to disengage either of the stone nuts when he does not require to use the set of stones driven by that nut. The stone nut is lifted out of mesh by turning the handle of the jack ring.



The cast iron pit wheel A in the cog pit is connected to the waterwheel by a steel axle B.



The iron cogs or teeth of the pit wheel A engage with those of the wallower C, a much smaller wheel which moves the rotation from a vertical to a horizontal plane. An upright shaft leads from the wallower C to the wooden-toothed great spur wheel D.

The pit wheel has a second wallower E. This transmits power to the large auxiliary wooden-toothed spur wheel F which engages with the iron cogged wheel, or drive gear, driving the bruiser shaft.

The great spur wheel D engages with two small iron pinions known as stone nuts. One of these drives the shelling stones and the other the grinding stones.

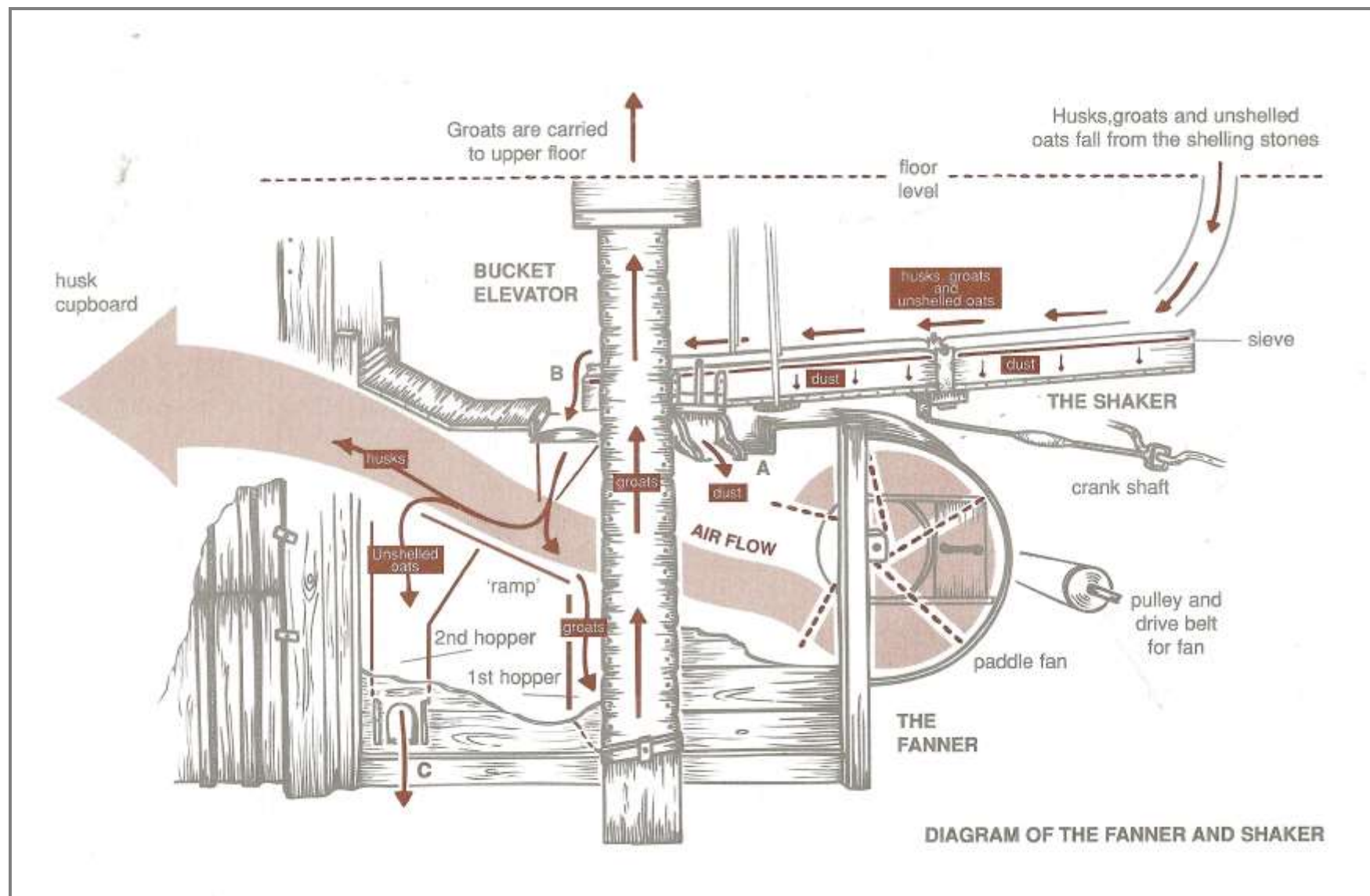


Diagram in Miller (1996, 25) on the separating process at Benholm from the shelling stones into the secondary machinery. © Aberdeenshire Council

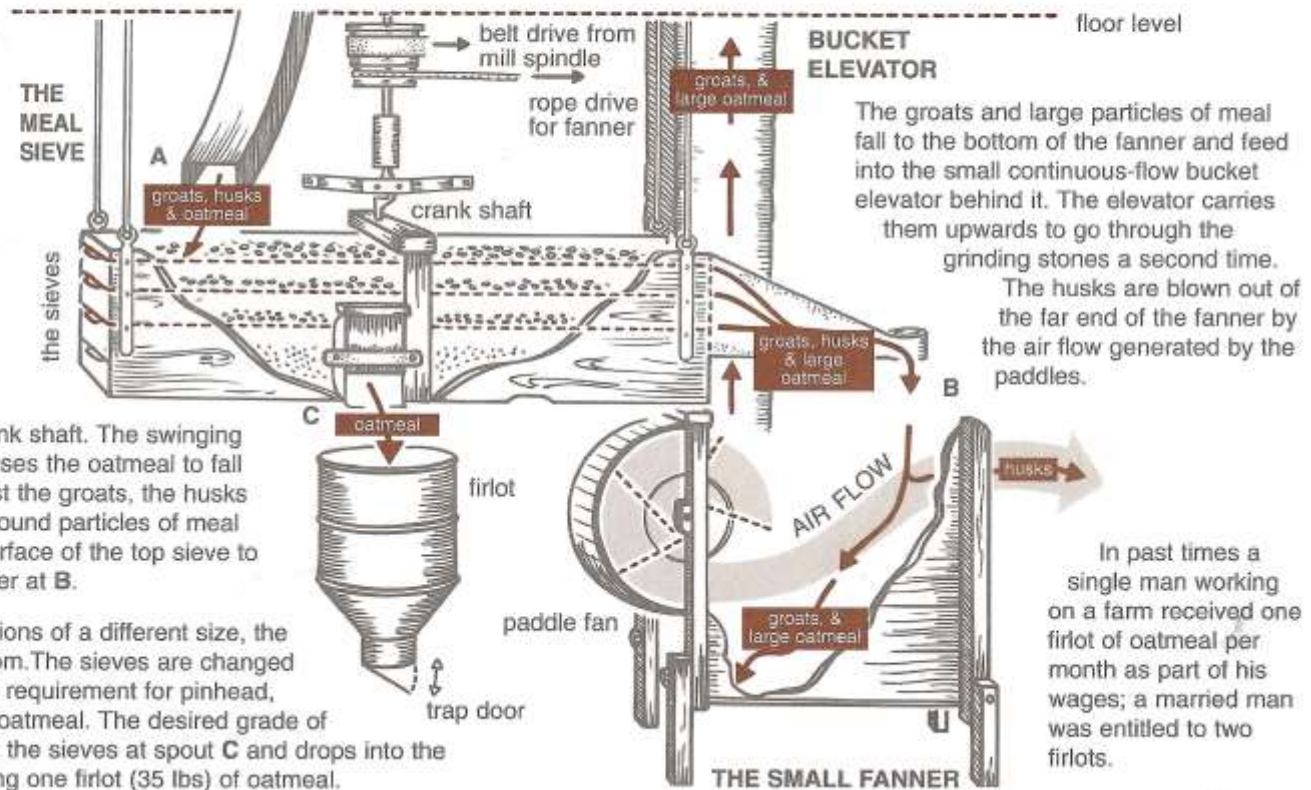
Sieving

The function of the meal sieve and small fanner is to remove any remaining unground groats and husks from

the end product, the oatmeal, and to sieve the meal to the required grade.

The oatmeal, unground groats and small husks emerge from the grinding stones at spout A and fall onto the meal sieve. The sieve consists of a series of wiremesh sieves fitted like drawers within a box which is suspended from above and shaken in a circular motion by a crank shaft. The swinging and shaking motion causes the oatmeal to fall through the sieves whilst the groats, the husks and any insufficiently ground particles of meal are carried along the surface of the top sieve to drop into the small fanner at B.

Each sieve has perforations of a different size, the finest being on the bottom. The sieves are changed according to the miller's requirement for pinhead, coarse, medium or fine oatmeal. The desired grade of oatmeal emerges below the sieves at spout C and drops into the firloft, a receptacle holding one firloft (35 lbs) of oatmeal.



In past times a single man working on a farm received one firloft of oatmeal per month as part of his wages; a married man was entitled to two firlofts.

Diagram in Miller (1996, 26) on the sieving process at Benholm from the milling stones into the secondary machinery. © Aberdeenshire Council

Meal Mill: Lower Floor

The lower floor of the meal mill contains the wheel gearing, various processing equipment and kiln fire box separated by a stone wall. Accessed on the main south elevation by double doors, with two additional single doors in the projecting southern extension. Exposed timber joists (some surviving from before mill restoration, some reconstruction). Modern paint finish to masonry walls (limewash remnants on exposed masonry). Three small glazed openings on the south elevations, with a larger fixed pane window in the east elevation at low level. Earth / concrete / flagstone floors.



General view looking east toward the gearing enclosure in 2023. The space has a confused appearance with the installation of safety barriers and removal of a substantial part of the earlier **Gear Cupboard** partition.



Similar view taken by WE Ltd during the restoration works. Part of the earlier timber **Gear Cupboard** has been cut away and the **Meal Sieve & Small Fanner** temporarily removed. Note the doors into the cupboard on the right – now removed.



General view looking west toward kiln fire pit in 2023. The space is cluttered by storage of modern items not associated with the mill operations.



Similar view taken by WE Ltd during the restoration works. The kiln fire pit is visible with the **Kiln Chute** to the right. Note the new timber floor joists above.



View of the southern extension in 2023. It is thought that the horse belts were brought to the mill by former custodian miller Pete Babs.









Similar view taken by WE Ltd during the restoration works. Note the **Auxiliary Spur Wheel** on the left, and its drive shaft behind already restored.






WE Ltd image (likely early 1991) before restoration works. Note the vertical **Pit Wheel** and the horizontal **Great Spur Wheel** above.






WE Ltd image (likely early 1991) before restoration works. Note the vertical **Pit Wheel** on the left and the vertical **Auxiliary Spur Wheel** on the right.

Item	Description & Images			Authenticity, Significance and Observations
<p>Meal Mill Lower Floor Entrance doors</p>	 <p>Unevenly sized double doors with cast iron security stay to narrower door leaf (note 1). Damaged lower boarding has been temporarily patched.</p>	 <p>Side entrance comprises a single door split horizontally. Located at abutment of extension to earlier mill building.</p>	 <p>Extension entrance, with door 'back to front' which suggests it was a later intervention to connect to the extended Engine House (removed).</p>	<p>Note 1: Double doors have historic graffiti on external face and are of high significance. Refer Gazetteer Part 1. The other doors are thought to be later in date.</p>
<p>Meal Mill Lower Floor Windows on south elevation</p>	 <p>Window at kiln end of earlier building. 4-pane fixed glass window (replacement).</p>	 <p>Window at foot of stair. 4-pane fixed glass window (replacement).</p>	 <p>Window in southern extension. 4-pane fixed glass window (replacement).</p>	<p>Small window by kiln previously had 6 panes with horizontal emphasis (refer Gazetteer Part 1). The openings are of medium significance reflecting development of the functions of the mill. The glazed timber windows date to the visitor centre adaptation and are not significant.</p>

<p>Meal Mill Lower Floor Windows on east elevation</p>	 <p>Window in southern extension, east wall. 6-pane fixed glass window (replacement).</p>			
<p>Meal Mill Lower Floor Timber stair between floors</p>				<p>Also refer to Gazetteer 3: Upper Floor.</p> <p>The underside is lined out with wallpapered timber boards, some with graffiti of Lindsay C Watson's daughter, Sheila (dated 1960s). The wallpaper indicates the boards were reused, possibly from the former miller's house when it was converted to farm use.</p>
	<p>View of the underside of the timber stair.</p>	<p>Detail of graffiti on the wallpaper.</p>	<p>Detail of reused boards.</p>	

<p>Meal Mill Lower Floor Grain Bruiser & Grister</p>	 <p>General view of Bruiser & Grister for production of animal feeds. (Refer Miller, 1996 and interpretation panel).</p>	 <p>Manufacturers' details on front and side. On front manufacturer "Harrison McGregor & Co. Ltd." On side "Leigh Lancashire" and "6154"; on wheel "Albion Patent Grinding" and "4522".</p>	 <p>Metal plate on timber base of Bruiser "A Milne Millwright Banchory".</p>	<p>Original hopper above Bruiser has been removed and floor infill panel visible.</p> <p>Former custodian miller Pete Babs confirmed the bruiser was not used during the building's use as a visitor centre.</p>
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<p>Meal Mill Lower Floor Bruiser Drive</p>	 <p>The Bruiser Drive transferred power from the waterwheel gearing to the Bruiser & Grister; or could be used with auxiliary power. The drive shaft extends through the south wall.</p>	 <p>Using water power, the Bruiser Drive shaft is driven by a small iron drive gear which engages with wooden cogs of the Auxiliary Spur Wheel. The drive gear can be disengaged when not in use or for use of an external auxiliary engine (as in image above).</p>	 <p>Wooden cogs of the Auxiliary Spur Wheel. There's also a good during shot of wallower on WE sheet</p>	<p>Auxiliary Spur Wheel: oiled beech wood cogs are replacements handmade during the restoration by John Turner and WE Ltd (original worn). "W S & Son" on iron centre piece of spokes (on iron 8 spoke wheel; yellow numbering added for alignment); square shaft.</p> <p>The space on the south side of the Auxiliary Spur Wheel is enclosed. Metal oval plate and threaded rod adjacent to extension door.</p>
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**Meal Mill Lower Floor
Bruiser Drive**



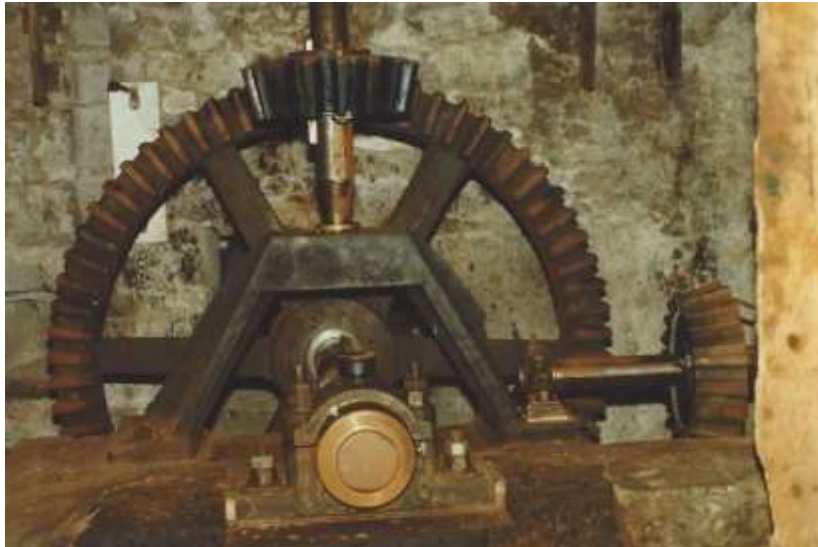
WE Ltd repaired hub on **Auxiliary Spur Wheel** (WE Ltd image).



The **Auxiliary Spur Wheel** before restoration, note the worn and damaged wooden teeth (WE Ltd image).

<p>Meal Mill Lower Floor Gear Cupboard</p>	 <p>View of the primary gearing in the gear cupboard before restoration. Note the earlier timber bridge tree replaced during the works. (WE Ltd image, c.1991).</p>	 <p>Similar view in 2023 with the new bridge tree in the foreground and steelwork added to support the gearing structure and floor joists above.</p>	 <p>View looking other way during the restoration with the Pit Wheel in place in the cog pit. (WE Ltd image).</p>	<p>All the primary machinery is of high significance as operable milling apparatus restored in the early 1990s using earlier / existing parts from the Mill of Benholm and salvaged from other Scottish mills such as Cowie Mill, Stonehaven.</p> <p>The Bridge Trees, massive wooden cross beams carry the weight of the runner stones in the upper floor on Mill Spindles. The stone nuts can be disengaged using the Jack Rings.</p>
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**Meal Mill Lower Floor
Gear Cupboard**









The **Pit Wheel** is operated by a horizontal steel axle from the **Waterwheel** and transfers power through a number of gears and drives to the milling apparatus. (WE Ltd image during restoration).



Wallowers at the top, and to the side of the **Pit Wheel** transfer its energy through drive shafts to the **Great Spur Wheel** and **Auxiliary Spur Wheel** respectively (not seen; Jack Ring just visible top-right).

<p>Meal Mill Lower Floor Gear Cupboard</p>	  <p>Wallowers being prepared during the restoration (WE Ltd image).</p>	 <p>View of the Great Spur Wheel which sits horizontally above the Pit Wheel on the main vertical drive shaft. (WE Ltd image).</p>	  <p>Image above shows the mill spindle and underside of the grinding bed stone; note its inscribed "City Mills Perth 1906". Mill spindle to the grinding stones with "Original B" on iron circular shaft.</p>	<p>The Great Spur Wheel will engage the Stone Nuts (small iron pinions) to drive the mill spindles of the Shelling and Grinding stones on the upper floor.</p> <p>"City Mills Perth 1906" inscribed into coating on underside of lower grinding stone is of significant interest but the connection is still be made.</p>
<p>Meal Mill Lower Floor Pit Wheel and waterwheel axle</p>	 <p>WE Ltd fabricated a new axle which it fitted through the external wall to the waterwheel. There is an intermediate bearing on the water wheel shaft where the shaft passes through the wall. (Note 2)</p>	 <p>WE Ltd during the works setting up the principal gearing of pit wheel, wallower and Great Spur Wheel (WE Ltd image).</p>	 <p>View of the gear cupboard in 2023.</p>	<p>Note 2: The original intermediate bearing support had been patched over the years. To improve support and restraint for the waterwheel WE Ltd enlarged the hole, added a steel bed plate to provide firm support for the plummer block with cement consolidation of existing wall.</p>

<p>Meal Mill Lower Floor Misc. items</p>				
<p>Meal Mill Lower Floor Free standing Fanner & Shaker</p>				<p>Supplier D. Irons & Sons, Agents, Forfar and a paper article about the fanner maker: J Baker, Falcon Works, Wizbech (Wisbech) Cambridgeshire, is pasted on its side. J Baker is mentioned in 1860s in relation to his agricultural inventions and it is very likely this item dates to around that period (Grace's Guide). Blair Atholl Mill has the same fanner originally supplied by an agent in Errol, salvaged and fitted during 1977 restoration. Described as a fanner used to 'clean' oats before drying.</p> <p>Possibly moved here as exhibit; not mentioned in 1983 survey.</p>

**Meal Mill Lower Floor
Shaker & Large
Fanner (along north
wall) & Bucket
Elevator**



General view of crank shaft, pulleys and drive belts for the **Shaker**.



The **Shaker**, a long sieve, above the **Large Fanner**, note the internal paddles which create an air flow from the fanner.






View of the **Large Fanner**. Groats are transported to the upper floor for grinding by the **Bucket Elevator**; unshelled oats are blown into a second hopper with an outlet at floor level (bottom left).







Groats (unshelled oats or kernels), husks, unshelled oats and dust from the **Shelling Stones** above are fed by a spout into the **Shaker**, a long sieve operated by a crank shaft. Dust drops through the sieve and is collected at the chute above the fanner. The remaining parts drop into the **Fanner** for air separation by its paddle fan. **Groats** fall into a hopper to be transported to the upper floor for grinding by the **Bucket Elevator**; **unshelled oats** are blown up a ramp into a second hopper with an outlet at floor level. **Husks** are blown into the adjoining **Husk Cupboard**.






“Shaking Sieve” under Shelling Stones recorded by Douglas (Canmore, survey, 1983. MS/500/35/83). Considered to be original to the mill and of high significance.



(Left) WE Ltd image (likely early 1991) before machinery restoration. The **Large Fanner** in the foreground and gear cupboard beyond.

<p>Meal Mill Lower Floor Shaker & Large Fanner (along north wall) & Bucket Elevator</p>	 <p>West end of the Large Fanner with second hopper for unshelled oats, currently inappropriately used for storage.</p>	 <p>View into the second hopper where unshelled oats were blown by the Large Fanner.</p>	 <p>Bucket Elevator encased in timber has metal cups (buckets) on a canvas felt in continuous flow taking Groats to the upper floor for discharge into bags. In the foreground the chute above the Large Fanner where dust is discharged from the Shaker sieve.</p>
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<p>Meal Mill Lower Floor Meal Sieve and Small Fanner</p>	 <p>View from southern extension to Meal Sieve and Small Fanner.</p>	 <p>Meal Sieve with metal chute at southern end over Small Fanner below. Metal spout at base of sieve projecting over funnel (presumably for bagging oatmeal).</p>	 <p>Detail of metal spout through floor from Grinding Stones above to discharge onto the Meal Sieve, with crank shaft behind.</p>	<p>Used to separate oatmeal from unground groats and small husks from the grinding stones. A metal spout from the tun above deposits them onto a series of 4no. wire mesh sieves suspended from the ceiling above. The sieves sit into a wooden box, and are shaken by a crank shaft via a belt drive from the mill spindle. Oatmeal will fall through the sieves (which are used to grade the oatmeal) to a metal spout at the base of the box; a metal bagging funnel is suspended from the ceiling. Groats and large particles of meal travel to the end of the sieves and are fed into a small fanner via a large metal trough. They fall to the bottom of the fanner and from there are fed into the continuous-flow bucket elevator for the grinding stones which deposits them into the stones for a second time. Air flow pushes husks out of the end of the Small Fanner where they are bagged. Small fanner damaged including broken leg.</p>
	 <p>Oatmeal grading sieve trays suspended in the Meal Sieve shaker.</p>	 <p>Small Fanner that separates husks from groats and feeds groats into the continuous-flow bucket elevator to the grinding stones.</p>	 <p>View of the Meal Sieve & Small Fanner prior to dismantling for restoration. © Mills Archive Trust: Jim Woodward-Nutt, 1983, image 10743: https://catalogue.millsarchive.org/benholm-harp</p>	<p>“Oat meal sieve with small fanner at outlet end as well as outlet into (grinding) bucket elevator” recorded by Douglas (Canmore, 1983, MS/500/35/83). Considered to be original to the mill and of high significance.</p>

<p>Meal Mill Lower Floor Husk Cupboard</p>	 <p>View of Husk Cupboard looking towards the Gear Cupboard.</p>	 <p>View of Husk Cupboard looking towards the kiln area.</p>	 <p>View into the Husk Cupboard looking west – disused / storage.</p>	<p>“Shell Cupboard” (recorded by Douglas (Canmore, 1983, MS/500/35/83). Considered to be an original feature of the mill although storage of items inside and against the cupboard make assessment of original material difficult. An outlet from this cupboard to the upper floor may have been removed.</p>
<p>Meal Mill Lower Floor Kiln Chute</p>	 <p>Kiln Chute includes a hopper under the outlet from the kiln above.</p>	 <p>Graffiti “G.D.C” and “J” on chute.</p>		<p>Also known as a “Bag Shot”</p>

**Meal Mill Lower Floor
Kiln fire box with
damper**



General view of the **kiln fire box**.



Kiln fire **damper**.



Shallow ash pit in front of the kiln fire box.



Detail of wall above forming the kiln opening on the south side – possible joist / timber rafter pockets.



Detail of wall forming the kiln opening on the south side – evidence of dressed stone opening.



View into the fire pit showing the built up construction forming the funnel shape below the wire mesh floor above.

Stepped stone structure thought to have been constructed against the earlier mill building. Evidence of dressed stone jamb margins and stone lintel suggesting former doorway / opening. Further lower stone lintel and walling to create fire box, infilled with brick to form arched fire box with damper above with cast iron door. Lower floor pit in front for ash.

From interpretation panel:
“The firebox is located in a former door opening, the arch of which can still be seen in the south wall” [west wall?].