Flour mill

THE EVOLUTION OF THE FLOUR MILL FROM PREHISTORIC AGES TO MODERN TIMES

Introductory article contributed by Mr. John Elton, joint-author of "The History of Corn Milling."

Before the first actual grinding mill came into existence, grain was merely shelled or husked by pounding. This simple kind of a "first break" was effected by spreading the grain upon a slab or block of stone and beating it with a hand stone; a subsequent development of this rude apparatus being a hollow mortar and an improved hand stone. The original hand pounder was used on a flat block, this being an early English specimen, sows the improved mortar and pounder, this being an early Welch sample. Such relics are found throughout both hemispheres, having been used by all primitive nations throughout the world; but eventually they were universally discarded for more perfect apparatus, which really ground the grain into meal.

The "saddle stone" so called from its more or less fanciful resemblance to a high peaked saddle. It is the most interesting of the whole series of hand stones, as being the first real hand mill-highly esteemed and used all over the globe. Saddle stones of the ordinary types of the stone made, and are used by kneeling in front of the stone, the operator used a back and forth method of working it. Though the loose hand stones seem to assume the form of rollers, still they were not so used; they were simply pushed backwards and forwards without any rolling motion, the grain (probably after being broken in a "Mortar") being placed on the lower stone in handfuls as required. Though we see it in use in Central Africa in modern times, it is found in the exploration of the relics of prehistoric ages; it abounds in the remains alike of rude historic periods and of the civilized days of early Egypt, Greece,

and Rome. Its chief survival is found in the "Metata" of Mexico and Central America generally, where it is in ordinary use grinding maize for the making of "Tortilla" cakes. A sample of extremely elegant form into which the Indians of Mexico carved these stones may be still found. But as the Saddle Stone had displaced the Mortar so it, itself, was displaced in turn by the next improvement - the "Quern."

In the Quern a rotary movement was for the first time introduced into the operation of grinding grain. The machine originally consisted of two circular stones of about equal diameter, the top stone resting on a pivot in its center, this pivot being fixed in the center of the lower stone. A wooden handle projected upwards from the top stone, and by this the latter was turned. The grain was placed in a hole or hopper in the upper stone, and as the latter revolved it gradually trickled through the top stone and was drawn "between the upper and the nether millstone." As it became reduced into meal it was automatically pressed to the circumference of the stones and expelled. The action of this simple hand stone was in fact nothing more or less than that of the water mill and wind mill, which were developed from it. The Quern is believed to have been a product of the civilization of the Roman age. "No early Greek writer mentions the revolving Quern, and the earliest allusion to it seems to be made by Cato (232-147B.C.)"; though after this date it can be identified through all ancient history. The Indians of American knew perfectly well the Mortar and the Saddle Stone, yet the relics of their period do not seem to disclose that they ever knew or used the Quern.

So vastly improved a mill as this became the subject of all kinds of development. Very early the bottom stone was made in conical form, the top stone being funnel shaped; this being to render the outflow of the meal easier. Another alteration was the provision of the rim round the bottom stone and a lip or spout at one side, the object here being to bring out the flow at one fixed spot. Grooving

the stones soon followed the mere roughening originally adopted, and many Roman and early British specimens show excellent samples of this ancient art. The grooved lower surface of the top stone, illustrates a rimmed and grooved lower stone. In modern times the rimmed lower stone was generally discarded for the original form, and those in use in the last century, in Scotland, for example, differed very little except in perfected mechanical detail from the querns of Ancient Rome.

The most notable early development made from the Quern was the horse Mill or Slave Mill in use a century B.C. It was nothing but a huge enlargement of the conical and funnel shaped stones, with the turning handle at the top abolished for a horizontal bar, to which slaves, horses, or asses were attached. The "Slave Mills" or Ass Mills" of Pompeii are seen to be constructed in this way. The fanciful representation of a Horse Mill on a marble carving in the Vatican, but it is in no degree indicative of the sorry beasts and the mean contrivances that were the actualities of the period.

While the Quern was in the height of its success as the premier mill of the world, there came about a final development which ultimately abolished both it and all other hand mills. The revolving principle of the Quern was retained, but human and cattle labor was abolished, and water power adopted instead. The vast change was made only about a century after the invention of the Quern had given its impetus to the construction of milling appliances; it being about the year 85 B.C. when the Greek, Antipater of Thessaloica, gave us the first allusion to a mill driven by water. The mill, as he knew it, is believed to be identical with a very primitive and crude contrivance that soon spread throughout Europe and Asia, and survives in some places still.

This Greek or "Norse Mill" consisted of a large Quern fixed above a stream, a vertical spindle being fixed in the top stone, but passing loosely through the bottom stone and desending into the stream,

where it was pivoted on a block of stone. A little way above the pivot, a horizontal water wheel was fixed on the spindle, and the stream playing down on the vanes of the water turned, with this latter, both the spindle and the top stone of the mill. such horizontal mills, the crudest know, have survived on a small scale till even the present day. Many of their small "Hurst" were formerly to be found in ordinary use by cottars and farmers in the Shetlands; the mosses of Ireland have yielded numerous relics of them; so frequently do they occur in Norway that the term "Norse Mill" is that by which they are now generally know; and they are met with in large numbers on the great Chig-tu Plain of China.

The Roman water mill, a much superior contrivance, was introduced about sixty years after the Greek mill, and, as described by Vitruvis about the year 20 B.C., was in all essential particulars identical with the world known water mill of modern times. the Roman improvement consisted of the abolition of the horizontal wheel in favor of the now well known vertical wheel; the Roman mill is similar to the present day mill comprising an almost literal specification of the ancient Roman milling engineer. From his day to our own the rudimentary principles of the universal water mill have never changed; its simplicity and general applicability kept it at the front as the only possible mill for no less a time than eleven hundred years.

Wind mills are of comparatively late origin. Amid many apocryphal allusions to wind mills of very remote periods, the earliest known was an English one erected at Bury St. Edmunds in 1191. The original type of wind mill the peg (or post) mill was built round an upright shaft fixed in the earth, and was laboriously pulled round from time to time to bring its sails up to the changing wind. This type seems to have been universal till as late as about 1595, when the Dutch were accredited with the invention of the fixed tower mill. it had a movable cap that could be turned to bring the sails up to the wind without turning the entire mill; but alter the

cap was made automatic in its action. Of course, the grinding apparatus of the wind mill was merely copied from that of the water mill, the only change being in the accessories suitable to the aerial motor.

Steam was first introduced into water mills solely for the purpose of pumping water from below the wheel back again into the race. This was the case about the years 1780-1790. But by 1784 the first known installation of steam as a driving power had taken place at the Albion Mills, Blackfriars Bridge, London, which, till their destruction by fire in 1791, were worked with great success.

Of roller milling little need hare be said. As early as 1651 iron rollers were advocated in England for the bruising of horse corn; a century later stone rollers, working at a differential speed, were suggested for the manufacture of flour. Little practical result arose from these and other crude ideas on the subject till, between the years 1820-1830, the system of roller milling was largely exploited in France, Austria, and Switzerland, and the initiative was definitely taken for the vast developments that have since been evolved.

Now that roller milling is so firmly established a fact in all the civilized countries of the world, the demands made upon the scientific and commercial attainments of the miller are infinitely greater than any previous age has seen. Necessarily, therefore, have arisen huge developments of that spirit of mutual co-operation among the members of the craft which their modern successors find essential still. The great milling nations of the present day all possess their Associations and Federations for promoting the welfare of the trade, and in the following pages is given some account of the history and constitution of the principal of these valuable aids to successful modern milling.


STONE & ROLLER FLOUR

Flour mills were classically powered by water, livestock or wind. A large stone (called the bedstone) was laid horizontally. A second stone (called the runner stone), with a shaft attached to its central axis and normally containing some type of hole for feeding the whole grain into the mill, is laid atop the bedstone. The second stone has some type of gearing or other means of causing it to turn around the central axis. Grain is fed in through the feed hole(s). It moves into the grooves in the runner stone and is ground between the two stones until it escapes through the grooves in the runner stone to the outside edge, where it collected for use as flour or meal. A very similar process is used for grains such as wheat, kamut, etc to make flour as well as for maize to make corn meal.

Image:Flour mill 20050723 001.jpg

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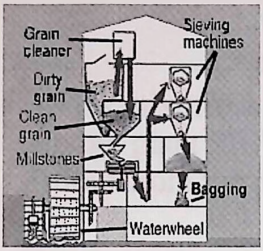
How Crabble Mill makes flour

Some simple recipes for scones & soda bread

What the customers wanted



Crabble Corn Mill is a restored, working Georgian watermill that uses water power to break up and crush wheat grain to make flour.

When it worked as a business during the 19th century, its customers wanted WHITE flour to bake white bread.

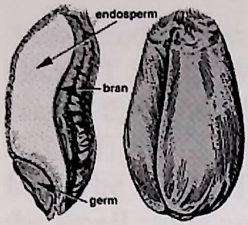
So it not only had MILLSTONES to crush the grain, but also SIEVING MACHINES to remove all the "brown bits" that customers didn't want.

Sacks of grain were hoist up into the Mill, and emptied into the DIRTY GRAIN BIN. A GRAIN CLEANER machine blew air through the grain to remove dust and mould. The clean grain was then fed down a pipe to the MILLSTONES. It is crushed into tiny fragments, and comes out as wholemeal flour - which is sieved to separate the WHITE FLOUR which is bagged ready for sale.

The wheat grain

This diagram shows the THREE parts of the wheat grain:

- The ENDOSPERM is the white floury filling inside the grain
- The GERM is the baby plant, that would sprout leaves and roots if it were planted in



the ground. The endosperm is a store of food for the growing plant, until it's able to draw on food from outside.

- The BRAN is the tough outer skin that protects the grain while its in the soil.

When the millstones crush the grain, the BRAN breaks into flakes mixed in with the white flour from the ENDOSPERM. The oily WHEATGERM tends to stick the whole lot together.

This mixture is WHOLEMEAL FLOUR - it had to be passed through giant SIEVING MACHINES to try and separate the white flour from the rest. Only the fine white white flour would fall through the sieve.

At Crabble, they sieved it through fine silk cloth - but even that didn't work well enough to produce really white flour. It was very slow (which was why they needed TWO big machines), and still some germ tended to stick the flour to the bran.

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Power for the Mill

Every thing in the Mill dates back to its original working period, from 1812 to 1893 - it is all powered by the waterwheel. Today you can see the waterwheel turn as the millers demonstrate how the Mill makes stoneground flour.

The gearing

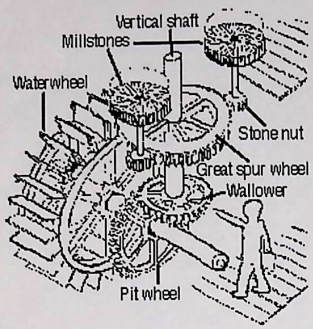
The waterwheel turns at about 6 revs a minute.

It is fixed to the PIT WHEEL, which turns the WALLOWER, another gear wheel

which turns the VERTICAL SHAFT- see diagram.

Also fixed on the vertical shaft is the GREAT SPUR WHEEL. This is much bigger than the Wallower, so the five small STONE NUTS around it turn round quite fast. The result of this "gearing up" is that the small stone nuts (which are fixed to the millstones) turn at 120 revs a minute - an ideal speed for 4 foot diameter millstones when grinding wheat.

The vertical shaft which runs up from the wallower drives all the machinery in the upper part of the Mill, through a series of belts and gear wheels


Vertical shaft
Millstones
Waterwheel
Stone nut
Great spur wheel
Wallower
Pit wheel