

PART THE FIFTH.

CHAPTER XIX.

Practical Instructions for building Mills, with all their proportions, suitable to all falls, of from three to thirty-six feet. Received from Thomas Ellicott, Mill-Wright.

PREFATORY REMARKS.

THIS part, as appears from the heading, written by Mr. Thomas Ellicott; a part of his preface, published in the early editions of this work, it has been thought best to omit. After some remarks upon the defective operation of mills upon the old construction, he proceeds to say—

In the new way, all these inconveniences and disadvantages are completely provided against: (See Plate XXII;) which is a representation of the machinery, as applied in the whole process of the manufacture; taking the grain from the ship or wagon, and passing it through the whole process by water, until it is completely manufactured into superfine flour. This is a mill of my planning and draughting, now in actual practice, built on Occoquam river, in Virginia, with 3 water-wheels, and 6 pair of stones.

If the wheat come by water to the mill, in the ship Z, it is measured and poured into the hopper A, and thence conveyed into the elevator at B, which elevates it, and drops it into the conveyer C D, which conveys it along under the joists of the second floor, and drops it into the hopper garner at D, out of which it is conveyed into the

main wheat elevator at E, which carries it up into the peak of the roof, and delivers it into the rolling-screen at F, which (in this plan) is above the collar beams, out of which it falls into the hopper G, thence into the short elevator at H, which conveys it up into the fan I, from whence it runs down slanting, into the middle of the long conveyer at J, that runs towards both ends of the mill, and conveys the grain, as cleaned, into any garner K K K K K K, over all the stones, which is done by shifting a board under the fan, to guide the grain to either side of the cog-wheel j; and although each of these garners should contain 2000 bushels of wheat, over each pair of stones 12000 bushels in 6 garners, yet nearly all may be ground out without handling it, and the feed of the stones will be more even and regular than is possible in the old way. As it is ground by the several pairs of stones, the meal falls into the conveyer at M M M, and is conveyed into the common meal elevator at N, which raises it to O; from thence it runs down the hopper-boy at P, which spreads and cools it over a circle of 10 or 15 feet diameter, and (if thought best) will rise over it, and form a heap two or three feet high, perhaps thirty barrels of flour, or more, at a time, which may be bolted down at pleasure. When it is bolting, the hopper-boy gathers it into the bolting hoppers at Q, and attends them more regularly than is ever done by hand. As it is bolted, the conveyer R, in the bottom of the superfine chest, conveys the superfine flour to a hole through the floor at S, into the packing chest, which mixes it completely. Out of the packing chest it is filled into the barrel at T, weighed in the scale U, packed at W by water, headed at X, and rolled to the door Y, then lowered down by a rope and windlass, into the ship again at Z.

If the wheat come to the mill by land, in the wagon 7, it is emptied from the bags into a spout that is in the wall, and it runs into the scale 8, which is large enough to hold a wagon load; and as it is weighed it is (by drawing a gate at bottom) let run into the garner D, out of which it is conveyed into the elevator at E, and so through the same process as before.

As much of the tail of the superfine reels 37 as we think will not pass inspection, we suffer to pass on into the short elevator, (by shutting the gates at the bottom of the conveyer next the elevator, and opening one farther towards the other end.) The rubblings, which fall at the tail of said reels, are also hoisted into the bolting hoppers of the sifting reel 39, which is covered with a fine cloth, to take out all the fine flour dust, which will stick to the bran in warm, damp weather; and all that passes through it is conveyed by the conveyer 40, into the elevator 41, which elevates it so high that it will run freely into the hopper-boy at O; and is bolted over again with the ground meal. The rubblings, that fall at the tail of the sifting reel 39, fall into the hopper of the middlings' reel 42; and the bran falls at the tail into the lower story. Thus, you have it in your power, either by day or night, without any hand labour, except to shift the sliders, or some such trifle, to make your flour to suit the standard quality; and the greatest possible quantity of superfine is made out of the grain, and finished completely at one operation.

Agreeably to request, I shall now attempt to show the method of making and putting water on the several kinds of water-wheels commonly used, with their dimensions, &c., suited to falls and heads of from 3 to 36 feet. I have also calculated tables for gearing them to millstones; and made draughts* of several water-wheels with their forebays, and manner of putting on the water, &c.

THOMAS ELLICOTT.

*All my draughts are taken from a scale of eight feet to an inch, except Plate XVII., which is four feet to an inch.

ARTICLE 119.

OF UNDERSHOT MILLS.

FIG. 1, Plate XIII., represents an undershot wheel, 18 feet diameter, with 3 feet total head and fall. It should be 2 feet wide for every foot the mill-stones are in diameter; that is, 8 feet between the shrouds for a 4 feet, and 10 feet wide for a 5 feet stone. It should have three sets of arms and shrouds, on account of its great width. Its shaft should be at least 26 inches in diameter. It requires 12 arms, 18 feet long, $3\frac{1}{2}$ inches thick, by 9 wide; and 24 shrouds, $7\frac{1}{2}$ feet long, 10 inches deep, by 3 thick, and 32 floats, 15 inches wide. Note—It may be geared the same as an overshot wheel, of equal diameter. Fig. 2 represents the forebay, with its sills, posts, sluice, and fall: I have, in this case, allowed 1 foot fall and 2 feet head.

Fig. 3 represents an undershot wheel, 18 feet diameter, with 7 feet head and fall. It should be as wide between the shrouds as the stone is in diameter; its shaft should be 2 feet in diameter; requires 8 arms, 18 feet long, $3\frac{1}{4}$ inches thick, by 9 wide; and 16 shrouds, $7\frac{1}{2}$ feet long, 10 inches deep, by 3 thick. It may be geared the same as an overshot wheel 13 feet in diameter, because their revolutions per minute will be nearly equal.

Fig. 4 represents the forebay, sluice, and fall: the head and fall about equal.

Fig. 5 represents an undershot wheel, 12 feet diameter, with 15 feet total head and fall. It should be 6 inches wide for every foot the stone is in diameter. Its shaft 20 inches in diameter; requires 6 arms, 12 feet long, 3 by 8 inches; and 12 shrouds, $6\frac{1}{2}$ feet long, $2\frac{1}{2}$ inches thick, and 8 deep. It suits well to be geared to a 5 feet stone with single gears, 60 cogs in the cog-wheel, and 16 rounds in the trundle; to a $4\frac{1}{2}$ feet stone, with 62 cogs and 15 rounds; and, to a 4 feet stone, with 64 cogs and 14 rounds. These gears will do well till the fall is reduced to 12 feet, only the wheel must be less, as

the falls are less, so as to make the same number of revolutions in a minute; but this wheel requires more water than a breast-mill, with the same fall.

Fig. 6 is the forebay, gate, shute, and fall. Forebays should be wide, in proportion to the quantity of water they are to convey to the wheels, and should stand 8 or 10 feet in the bank, and be firmly joined, to prevent the water from breaking through; which it will certainly do, unless they be well secured.

ARTICLE 120.

DIRECTIONS FOR MAKING FOREBAYS.

The best way with which I am acquainted, for making this kind of forebays, is shown in Plate XVII., fig. 7. Make a number of solid frames, each consisting of a sill, two posts, and a cap; set them cross-wise, (as shown in the figure,) $2\frac{1}{2}$ or 3 feet apart; to these the planks are to be spiked, for there should be no sills lengthwise, as the water is apt to find its way along them. The frame at the head next the water, and one 6 or 8 feet downwards in the bank, should extend 4 or 5 feet on each side of the forebay into the bank, and be planked in front, to prevent the water, and vermin, from working round. Both of the sills of these long frames should be well secured, by driving down plank edge to edge, like piles, along the upper side, from end to end.

The sills being settled on good foundations, the earth or gravel must be rammed well on all sides, full to the top of the sills. Then lay the bottom with good, sound plank, well jointed and spiked to the sills. Lay your shute, extending the upper end a little above the point of the gate when full drawn, to guide the water in a right direction to the wheel. Plank the head to its proper height, minding to leave a suitable sluice, to guide the water smoothly down. Fix the gate in an upright position—hang the wheel, and finish it off, ready for letting on the water.

