

## CHAPTER XXII.

## ARTICLE 153.

## OF THE USE OF DRAUGHTING TO BUILD MILLS BY, &amp;c.

Perhaps some are of opinion that draughts are useless pictures of things, serving only to please the fancy. This is not what is intended by them; but to give true ideas of the machine, &c., described, or to be made. Those represented in the plates are all drawn on a scale of  $\frac{1}{8}$ th of an inch to a foot, in order to suit the size of the book, except Plate XVII., which is a quarter of an inch to a foot; and this scale I recommend, as most buildings will then come on a sheet of common paper.

N. B. Plate XXIV. was made after the above directions, and has explanations to suit it.

The great use of draughting mills, &c., to build by, is to convey our ideas more plainly, than is possible by writing, or by words alone; these may be misconstrued or forgotten; but a draught, well drawn, speaks for itself, when once understood by the artist; who by applying his dividers to the draught and to the scale, finds the length, breadth, and height of the building; or the dimensions of any piece of timber, and its proper place.

By the draught the bills of scantling, boards, rafters, laths, shingles, &c. &c., are known and made out; it should show every wheel, shaft, and machine, and their places. By it we can find whether the house be sufficient to contain all the works that are necessary to carry on the business; the builder or owner understands what he is about, and proceeds cheerfully and without error: it directs the mason where to put the windows, doors, navel-holes, the inner walls, &c., whereas, if there be no draught, every thing goes on, as it were, in the dark; much time is lost and errors are committed to the loss of many pounds. I have heard a man say, that he believed his mill was 500*l.* better from having employed an experienced artist, to draw him a draught to build it by; and I know, by experience, the great utility of them. Every master builder, at least, ought to understand them.

## ARTICLE 154.

## DIRECTIONS FOR PLANNING AND DRAUGHTING MILLS.

1st. If it be a new seat, view the ground where the dam is to be, and where the mill-house is to stand, and determine on the height of the top of the water in the head race, where it is taken out of the stream; and level from it for the lower side of the race, down to the seat of the mill-house, and mark the level of the water in the dam there.

2ndly. Begin where the tail-race is to empty into the stream, and level from the top of the water up to the mill seat, noticing the depth thereof, in places, as you pass along, which will be of use in digging it out.

Then find the total fall, allowing one inch to a rod for fall in the races; but if they be very wide and long, less will do.

Then, supposing the fall to be 21 feet 9 inches, which is sufficient for an overshot mill, and the stream too light for an undershot; consider well what size stone will suit; for I do not recommend a large stone to a weak, nor a small one to a strong stream. I have proposed stones 4 feet diameter for light, 4,6 for middling, and 5 or 5 feet 6 inches diameter, for heavy streams. Suppose you determine on stones 4 feet, then look in table I., (which is for stones of that size,) column 2, for the fall that is nearest 21 feet 9 inches, your fall, and you find it in the 7th example. Column 3d contains the head of water over the wheel, 3 feet; 4th, the diameter of the wheel, 18 feet; 5th, its width 2 feet 2 inches, &c., for all the proportions to make the stone revolve 106 times in a minute.

Having determined on the size of the wheels, and also of the house; the heights of the stories, to suit the wheels, and machinery it is to contain, and the business to be carried on therein, proceed to draw a ground plan of the house, such as Plate XVIII., which is 32 by 55 feet. (See the description of the plate.) And for the second story, as plate XIX., &c., and for the 3d, 4th, and 5th floors, if

required; taking care to plan every thing, so that one shall not clash with another.

Draw an end view, as Plate XX., and a side view, as Plate XXI. Take the draught to the ground, and stake out the seat of the house. It is, in general, best to set that corner of an overshot mill, at which the water enters, farthest in the bank; but great care should be taken to reconsider and examine every thing, more than once, to see whether it be planned for the best; because, much labour is often lost for want of due consideration, and by setting buildings in, and laying foundations on, wrong places. The arrangements being completed, the bills of scantling and iron work may be made out from the draught.

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ARTICLE 155.

BILLS OF SCANTLING FOR A MILL, 32 BY 55 FEET, 3 STORIES HIGH; THE WALLS OF MASON WORK, SUCH AS IS REPRESENTED IN PLATES XVIII., XIX., XX., AND XXI.

*For the first Floor.*

2 sills, 29 feet long, 8 by 12 inches, to lay on the walls for the joists to lie on.

48 joists, 10 feet long, 4 by 9 inches; all of timber that will last well in damp places.

*For the second Floor.*

2 posts, 9 feet long, 12 by 12 inches.

2 girders, 30 feet long, 14 by 16 do.

48 joists, 10 feet long, 4 by 9 do.

*For the Floor over the Water-House.*

1 cross girder, 30 feet long, 12 by 14 inches, for one end of the joists to lie on.

2 posts to support the girder, 12 feet long, 12 by 12 inches.

16 joists, 13 feet long, 4 by 9 inches; all of good white-oak, or other timber, that will last in damp places.

*For the third Floor.*

- 4 posts, 9 feet long, 12 by 12 inches, to support the girders.
- 2 girder posts, 7 feet long, 12 by 12 inches, to stand on the water-house.
- 2 girders, 53 feet long, 14 by 16 inches.
- 90 joists, 10 feet long, 4 by 9 inches.

*For the fourth Floor.*

- 6 posts, 8 feet long, 10 by 10 inches, to support the girders.
- 2 girders, 53 feet long, 13 by 15 inches.
- 30 joists, 10 feet long, 4 by 8 do. for the middle tier of the floor.
- 60 do. 12 feet do. 4 by 8, for the outside tiers, which extend 12 inches over the walls, for the rafters to stand on.
- 2 plates, 54 feet long, 3 by 10 inches: these lie on the top of the walls, and the joists on them.
- 2 raising pieces, 55 feet long, 3 by 5 inches; these lie on the ends of the joists for the rafters to stand on.

*For the Roof.*

- 54 rafters, 22 feet long, 3 inches thick, 6½ wide at the bottom, and 4½ at the top end.
- 25 collar beams, 17 feet long, 3 by 7 inches.
- 2760 feet of laths, running measure.
- 7000 shingles.

*For Doors and Window-Cases.*

- 12 pieces, 12 feet long, 6 by 6 inches, for door-cases.
- 36 do. 8 feet long, 5 by 5 inches, for window-cases.

*For the Water-House.*

- 2 sills, 27 feet long, 12 by 12 inches.
- 1 do. 14 feet long, 12 by 12 do.
- 2 spur-blocks, 4 feet 6 inches long, 7 by 7 do.
- 2 head-blocks, 5 feet long, 12 by 14 do.
- 4 posts, 10 feet long, 8 by 8, to bear up the penstock.
- 2 cap-sails, 9 feet long, 8 by 10, for the penstock to stand on.

4 corner posts, 5 feet long, 4 by 6 inches, for the corners of the penstock.

*For the Husk of a Mill of one Water-Wheel and two Pair of Stones.*

2 sills, 24 feet long, 12 by 12 inches.

4 corner posts, 7 feet long, 12 by 14 inches.

2 front posts, 8 feet long, 8 by 12 do.

2 back posts, 8 feet do. 10 by 12 inches, to support the back ends of the bridge-trees.

2 other back posts, 8 feet long, 8 by 8 inches.

3 tomkin posts, 12 feet long, 12 by 14 do.

2 interties, 9 feet long, 12 by 12 inches, for the outer ends of the little cog-wheel shafts to rest on.

2 top pieces, 10 feet 6 inches long, 10 by 10 inches.

2 beams, 24 feet long, 16 by 16 inches.

2 bray-trees, 8½ feet long, 6 by 12 inches.

2 bridge-trees, 9 feet long, 10 by 10 inches.

4 planks, 8 feet long, 6 by 14 inches, for the stone-bearers.

20 planks, 9 feet long, 4 by about 15 inches, for the top of the husk.

2 head-blocks, 7 feet long, 12 by 15 inches, for the wallower shafts to run on. They serve as spurs also for the head-block for the water-wheel shaft.

*For the Water-Wheel and big Cog-Wheel.*

1 shaft, 18 feet long, 2 feet diameter.

8 arms for the water-wheel, 18 feet long, 3 by 9 inches.

16 shrouds, 8½ feet long, 2 inches thick, and 8 deep.

16 face boards, 8 feet long, 1 inch thick, and 9 deep.

56 bucket boards, 2 feet 4 inches long, and 17 inches wide.

140 feet of boards, for soaling the wheel.

3 arms for the cog-wheel, 9 feet long, 4 by 14 inches.

16 cants, 6 feet long, 4 by 17 inches.

*For little Cog-Wheels.*

2 shafts, 9 feet long, 14 inches diameter.

4 arms, 7 feet long, 3½ by 10 inches.

16 cants, 5 feet long, 4 by 18 inches.

*For Wallowers and Trundles.*

60 feet of plank,  $3\frac{1}{2}$  inches thick.  
 40 feet do. 3 inches thick, for bolting gears.

*Cogs and Rounds.*

200 cogs, to be split, 3 by 3, 14 inches long.  
 80 rounds, do. 3 by 3, 20 inches long.  
 160 cogs, for bolting works, 7 inches long, and  $1\frac{1}{4}$  square;  
 but if they be for a mill with machinery complete,  
 there must be more in number, accordingly.

*Bolting Shafts.*

1 upright shaft, 14 feet long,  $5\frac{1}{2}$  by  $5\frac{1}{2}$  inches.  
 2 horizontal shafts, 17 feet long, 5 by 5 inches.  
 1 upright do. 12 feet long, 5 by 5 inches.  
 6 shafts, 10 feet long, 4 by 4 do.

## ARTICLE 156.

## BILL OF THE LARGE IRONS FOR A MILL OF TWO PAIR OF STONES.

2 gudgeons, 2 feet 2 inches long in the shaft; neck  $4\frac{1}{4}$  inches long, 3 inches diameter, well steeled and turned.  
 (See fig. 16, Plate XXIV.)  
 2 bands, 19 inches diameter inside,  $\frac{3}{4}$  thick; and 3 inches wide, for the ends of the shaft.  
 2 do.  $20\frac{1}{2}$  inches inside,  $\frac{1}{2}$  an inch thick, and  $2\frac{1}{2}$  inches wide, for do.  
 2 do. 23 inches do.  $\frac{1}{2}$  an inch thick, and  $2\frac{1}{2}$  inches wide, for do.  
 4 gudgeons, 16 inches in the shaft,  $3\frac{1}{2}$  inches long, and  $2\frac{1}{2}$  inches diameter in the neck, for wallower shafts:  
 (See fig. 15, Plate XXIV.)  
 4 bands, 12 inches diameter inside,  $\frac{1}{2}$  an inch thick, and 2 wide, for do.  
 4 do. 12 inches do.  $\frac{1}{2}$  an inch thick, and 2 wide, for do.  
 4 wallower bands, 3 feet 2 inches diameter inside, 3 inches wide, and  $\frac{1}{4}$  of an inch thick.  
 4 trundle bands, 2 feet diameter inside, 3 inches wide, and  $\frac{1}{4}$  of an inch thick.

- 2 spindles and rynes; spindles 5 feet 3 inches long from the foot to the top of the necks; cock-heads 7 or 8 inches long above the necks; the body of the spindles  $3\frac{1}{4}$  by 2 inches; the neck 3 inches long, and 3 inches diameter: the balance rynes proportional to the spindles, to suit the eye of the stone, which is 9 inches diameter. (See fig. 1, 2, 3, Plate XXIV.)
- 2 steps for the spindles, fig. 4.
- 2 sets of damsel-irons, 6 knockers to each set.
- 2 bray-irons, 3 feet long,  $1\frac{3}{4}$  inches wide, & an inch thick: being a plain bar, one hole at the lower, and 5 or 6 at the upper end.

*Bill of Iron for the Bolting and Hoisting Works, in the common way.*

- 2 spur-wheel bands, 20 inches diameter from outside, for the bolting spur-wheel,  $\frac{3}{4}$ ths of an inch wide, and  $\frac{1}{4}$ th thick.
- 2 spur-wheel bands, 12 inches diameter from outside, for the hoisting spur-wheel.
- 2 step-gudgeons and steps, 10 inches long,  $1\frac{1}{8}$  inches thick in the tang, or square part; neck 3 inches long, for the upright shafts. (See fig. 5 and 6, Plate XXIV.)
- 2 bands for do. 5 inches diameter inside,  $1\frac{1}{4}$  wide, and  $1\frac{1}{4}$  thick.
- 2 gudgeons, 9 inches tang; neck 3 inches long,  $1\frac{1}{8}$  square, for the top of the uprights.
- 8 bands,  $4\frac{1}{2}$  inches diameter inside.
- 1 socket-gudgeon,  $1\frac{1}{8}$  of an inch thick; tang 12 inches long; neck 4 inches; tenon to go into the socket  $1\frac{1}{2}$  inches, with a key-hole at the end. (See fig. 8 and 9.)
- 14 gudgeons, neck  $2\frac{1}{2}$  inches, tangs 8 inches long, and 1 inch square, for small shafts at one end of the bolting-reels.
- 10 bands for do. 4 inches diameter inside, and 1 inch wide.
- 4 socket-gudgeons, for the 4 bolting-reels,  $1\frac{1}{4}$  square; tangs 8 inches; necks 3 inches, and tenons  $1\frac{1}{2}$  inches, with holes in the ends of the tangs for rivets, to keep them from turning; the sockets 1 inch thick at the mortise, and 3 inches between the prongs. (See fig. 8 and 9.) Prongs 8 inches long and 1 wide.

8 bands,  $3\frac{1}{4}$  inches, and 8 do. 4 inches, diameter, for the bolting-reel shafts.

*For the Hoisting Wheels.*

2 gudgeons, for the jack-wheel, neck  $3\frac{1}{2}$  inches, and tang 9 inches long,  $1\frac{1}{8}$  square.

2 bands for do.  $4\frac{1}{2}$  inches diameter.

2 gudgeons, for the hoisting wheel, neck  $3\frac{1}{2}$  inches, tang 9 inches long, and  $1\frac{1}{4}$  inches square.

2 bands for do. 7 inches diameter.

6 bands for bolting-heads, 16 inches diameter inside,  $2\frac{1}{4}$  wide, and  $\frac{1}{8}$ th of an inch thick.

6 do. for do. 15 inches do. do.

N. B. All the gudgeons should taper a little, and the sides given are the largest part. The bands for shafts should be widest at the foremost side, to make them drive well; but those for heads should be both sides equal. Six picks for the stones, 8 inches long, and  $1\frac{1}{4}$  wide, will be wanted.

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ARTICLE 157.

EXPLANATION OF THE PLATES.

PLATE XVII.

Drawn from a scale of a quarter of an inch for a foot.  
Fig. 1—a big cog-wheel, 8 feet  $2\frac{1}{2}$  inches the diameter of its pitch circle, 8 feet  $10\frac{1}{2}$  inches from out to out; 69 cogs,  $4\frac{1}{2}$  inches pitch.

2—a little cog-wheel, 5 feet  $10\frac{1}{3}$  inches the diameter of its pitch circle, and 6 feet 6 inches from out to out, to have 52 cogs,  $4\frac{1}{4}$  pitch.

3—a wallower, 3 feet  $1\frac{1}{2}$  inches the diameter of its pitch circle, and 3 feet  $4\frac{1}{4}$  inches from out to out; 26 rounds,  $4\frac{1}{2}$  pitch.

4—a trundle, 1 foot  $8\frac{1}{3}$  inches the diameter of its pitch circle, and 1 foot  $11\frac{1}{3}$  inches from out to out; 15 rounds,  $4\frac{1}{4}$  inches pitch.

5—the back part of the big cog-wheel.

6—a model of locking 3 arms together.

7—the plan of a forebay, showing the sills, caps, and

where the mortises are made for the posts, with a rack at the upper end to keep off the trash.

PLATE XVIII. — *The Ground-Plan of a Mill.*

- Fig. 1 and 8—bolting chests and reels, top view.  
 2 and 4—cog-wheels that turn the reels.  
 3—cog-wheel on the lower end of a short upright shaft.  
 5 and 7—places for the bran to fall into.  
 6, 6, 6—three garners on the lower floor for bran.  
 9 and 10—posts to support the girders.  
 11—the lower door to load wagons, horses, &c., at.  
 12—the step-ladder, from the lower floor to the husk.  
 13—the place where the hoisting casks stand when filling.  
 14 and 15—the two meal-troughs and meal-spouts.  
 16—meal-shaking sieve for Indian and buckwheat.  
 17—a box for the bran to fall into from the sieve.  
 18 and 19—the head-block and long spur-block, for the big shaft.  
 20—four posts in front of the husks, called bray posts.  
 21—the water and cog-wheel shaft.  
 22—the little cog-wheel and shaft, for the lower stones.  
 23—the trundle for the burr stones.  
 24—the wallower for do.  
 25—the spur-wheel that turns the bolts.  
 26—the cog-wheel.  
 27—the trundle, head wallower, and bridge-tree, for country stones.  
 28—the four back posts of the husk.  
 29—the two posts that support the cross-girder.  
 30—the two posts that bear up the penstock at one side.  
 31—the water-wheel, 18 feet diameter.  
 32—the two posts that bear up the other side of the penstock.  
 33—the head-blocks and spur-blocks, at water end.  
 34—a sill to keep up the outer ends.  
 35—the water-house door.  
 36—a hole in the wall for the trunk to go through.  
 37—the four windows of the lower story.

PLATE XIX.—*Second Floor.*

- Fig. 1 and 9—a top view of the bolting chests and reels.  
 2 and 10—places for the bran to fall into.  
 3 and 8—the shafts that turn the reels.  
 4 and 7—wheels that turn the reels.  
 5—a wheel on the long shafts between the uprights.  
 6—a wheel on the upper end of the upright shaft.  
 11 and 12—two posts that bear up the girders of the third floor.  
 13—the long shaft between two uprights.  
 14—five garners to hold toll, &c.  
 15—a door in the upper side of the mill-house.  
 16—a step ladder from 2d to 3d floor.  
 17—the running burr mill-stone laid off to be dressed.  
 18—the hatch way.  
 19—stair way.  
 20—the running country stone turned up to be dressed.  
 21—a small step-ladder from the husk to 2d floor.  
 22—the places where the cranes stand.  
 24—the pulley-wheel that turns the rolling screen.  
 25 and 26—the shaft and wheel which turn the rolling screen and fan.  
 27—the wheel on the horizontal shaft to turn the bolting reels.  
 28—the wheel on the upper end of the first upright shaft.  
 29—a large pulley that turns the fan.  
 30—the pulley at the end of the rolling screen.  
 31—the fan.  
 32—the rolling screen.  
 33—a step ladder from the husk to the floor over the water-house.  
 34 and 35—two posts that support the girders of the third floor.  
 36—a small room for the tailings of the rolling screen.  
 37—a room for the fannings.  
 38—do. for the screenings.  
 39—a small room for the dust.  
 40—the penstock of water.  
 41—a room for the miller to keep his books in.

42—a fire-place.

43—the upper end door.

44—ten windows in the second story, twelve lights each.

### PLATE XX.

Represents a view of the lower side of a stone mill-house, three stories high, which plan will suit tolerably well for a two story house, if the third story be not wanted. Part of the wall is supposed to be open, so that we have a view of the stones, running gears, &c.

Line 1 represents the lower floor, and is nearly level with the top of the sills, of the husk and water-house.

2, 3, and 4—the second, third, and fourth floors.

5 and 6—windows for admitting air under the lower floor.

7—the lower door, with steps to ascend to it, which commonly suits best to load from.

8—the arch over the tail-race for the water to run from the wheel.

9—the water-house door, which sometimes suits better to be at the end of the house, where it makes room to wedge the gudgeon.

10—the end of the water-wheel shaft.

11—the big cog-wheel shaft.

12—the little cog-wheel and wallower, the trundle being seen through the window.

13—the stones with the hopper, shoe, and feeder, as fixed for grinding.

14—the meal-trough.

There is an end view of the husk frame. There are thirteen windows with twelve lights each.

### PLATE XXI.

Represents an outside view of the water-end of a mill-house, and is intended to show to the builders, and mill-wrights, the height of the walls, floors, and timbers, with the places of the doors and windows, and a view of the position of the stones and husk timbers, supposing the wall open, so that we could see them.

Fig. 1, 2, 3, and 4, shows the joists of the floors.