## The Farm.

### Levelling Drains—Cost of Draining our Experiment Grounds.

Autumn is one of the most convenient seasons that can be devoted to drainage. There is, however, one difficulty that presents itself to the unexperienced drainer at this season, which he is not liable to meet with in the spring, viz., the levelling of the drain. In spring, when there is an abundance of water in the soil, it is frequently not necessary to level at all. If there is a fixed outlet, a farmer cannot be far astray if he digs the drain the required depth at its outlet and then observes that "the water is following him up." This means that there is an equal depth of water on all parts of the finished bottom of the drain flowing evenly and gradually towards the outlet.

In the fall of the year, especially if it is a dry one, this natural level is, however, generally wanting, and the drainer has to use other methods. The unaided eye, however experienced, ought not to be depended upon for determining the level, for a slight mistake in this matter might cause the tile to fill up and destroy the usefulness of the drain.

The instrument we employed to find the level of the drains dug in our experimental field this spring is represented at figure I, at S and T, and consists of a common spirit-level, *a*; a piece of board, *b*; 2 pieces of scantling 5 feet long, *cc*, and a measuring pole, marked in feet and inches, 12 feet long. The board (*b*) may be of any convenient length, say between 6–10 feet. Its upper edge should be carefully and exactly plained with a jointer. The two pieces of scantling (*cc*) should be pointed, so that they can be driven into the ground at the lower end, and bolted with their upper ends to the side of the board near its ends, as represented in the cut. The exactness of the instrument depends upon the straightness of the upper edge of the board and the accuracy of the spirit-level. Before going out to level a given line, secure the services of an assistant and equip yourself with your instrument, a measuring pole, a measuring chain or tape line, pieces of shingles to be used as marks, and a pocket-book and pencil. Then go to work and plant your instrument on the line to be leveled, and at such a distance from one end of it that you can plainly see at what place on the measuring pole (held by the assistant at the end of the line,) it strikes. This distance varies much and depends on the accuracy of the instrument, the surface of the field to be leveled, and the sight of the operator. The planting of the instrument means to erect and level it. When you think the instrument stands level, it is well to change the spirit-level, end for end, to see if it indicates the same in both positions. When making an observation, remove the spirit-level, and then look along the edge of the board, noting

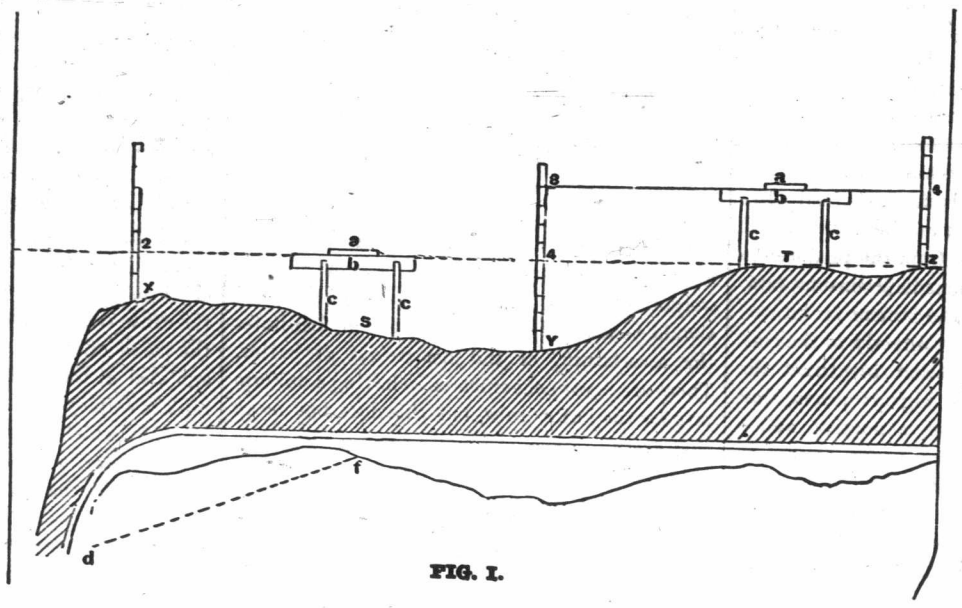


FIG. I.

at what place the continued line of its edge strikes the measuring pole. The place where the instrument is first erected is called station No. 1, and the observation first made is called the foresight of that station. If *x* represents the end of the drain shown in Fig. I, then S would be called station No. 1, *x* would represent the foresight of that station and *y* the backsight of the same. The backsight is obtained by leaving the instrument in the same place, the assistant carrying the measuring pole past the instrument and placing it on the line to be leveled at some distance from the operator, say at *y*, after which the operator takes a second observation in the opposite direction to the first one. After both these observations have been made, the operator carries his instrument past his assistant and plants it at a place similar to position T in Fig. I. From this point he takes a foresight towards *y* (8 feet), backsight towards *x* (4 feet), after which he moves on to station No. 3, and repeats here, as well as in all subsequent stations, the same operation as that gone through at No. 1. The assistant must mark with the pieces of shingles he has taken along, all the points at which he erected his measuring pole for the purpose of making an observation, so that when all the observations have been made, both of the operators may return and measure the distance between each foresight and backsight.

By looking at figure I, it can be easily seen that if the foresight *x* reads 2 feet, and the backsight *y* 4 feet, that there must be a rise of 2 feet towards *x*, and if foresight *y* reads 8 feet and backsight *x* 4 feet, that in this case there must be a fall of 4 feet towards foresight *y*. In the one case there is a fall of 4 feet towards the foresight, and in the other a rise of 2 feet, therefore the point *z* must be two feet higher than *x*.

A good method to note the readings of the different sights or observations taken in the field is to divide a page of the note-book into three columns. In those on the outside note the readings of the foresights and backsights, and in the central one the distance between them. Then add up all three columns. The central column will indicate the distance between the starting and the end point, and the difference between the two side columns will indicate the rise or fall between the two points. If the backsight gives the smaller sum, then the fall will be towards the starting point of observation, but if their sum is the larger, the fall will be towards the end of the line of observation. For example, taking the distance between *x* and *y* to be 200 feet, and between *y* and *z* 250 feet, then the following table will represent the field notes for figure I:

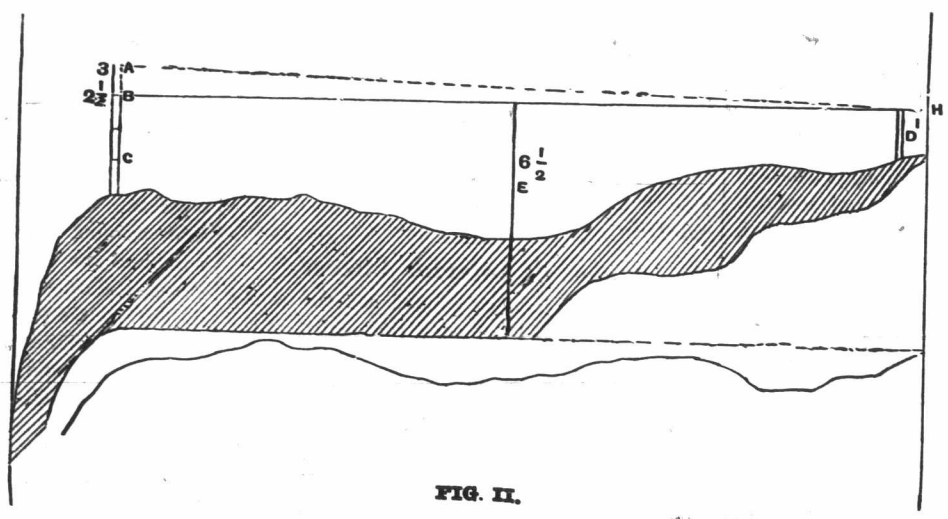


FIG. II.

| Foresight. | | Distance. | | Backsight. | |
|---|---|---|---|---|---|
| ft. | in. | ft. | in. | ft. | in. |
| 2 | | 200 | | 4 | |
| 8 | | 250 | | 4 | |
| 10 | | 450 | | 8 | |

Ten feet—8 ft. = 2 foot fall towards the outlet of the drain or towards the foresight *x*.

The fall of drains that form an angle or a curve may be checked by placing the instrument on a line drawn between the two terminations of the drain, as shown in figure I, by the line *d f*.

Having determined the natural fall between the two ends of a straight drain, the next point to be considered is to provide for a method of obtaining a straight and uniform bottom. For this purpose drive two stakes at the ends of the drain in a direct line with the centre of the drain. The ends of both of these poles should be on a level, viz., if there be two feet fall between the points