Whatever material we are to use, we may start by taking three draws of the common spade, each draw to be carefully shovelled out by the second man working with his face to the digger, who works backwards. This will give us about 3 x 9 27 inches in depth, and, at our proposed depth of 33 inches, as the shallowest admissible, it is time to think of the bottoming.

Suppose we are going to use bushes. The brush should have been prepared in winter, or at any rate when the leaf is off, and should consist of fresh, limber twigs about 3 feet long, as full of life as possible, and with nothing thicker than half an inch in diameter amongst them. If any of the boughs seem inclined to lie awkwardly, a slight tap with a sharp axe will correct the fault.

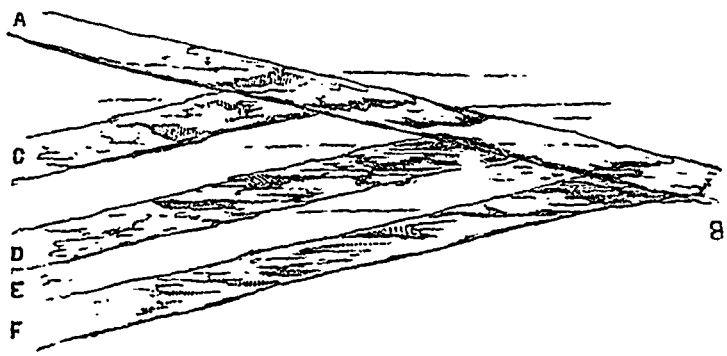

Fig. 3.

The drainer, still working backwards, should remove the remaining 6 inches with the narrowest spade, leaving the bottom 4 inches wide, and neatly finished, taking out the crumbs with the flat draw scoop. You may observe that there will in this case be a trough left at the bottom of the drain 6 inches deep, by 4 in width. This is the real conduit, the bushes are only meant to keep it open. In a few years they will perish, but the arch of the drain will remain for several years more if treated as I shall advise in the sequel.

The drain being now ready to receive its filling, let the workman take a sufficient quantity of the bushes in his hands, straightening them as much as possible, and lay them carefully at the bottom of the drain, trampling them firmly down. Then another man, a boy will do, should hand the drainer a fresh bundle to be laid further on, but with the top ends resting on the bottom end of the first bundle, and so on up the drain as far as it has been bottomed out. Care should be taken not to brush in the earth from the sides.

Now the filling-in may begin. Remembering that the water is to enter the drain from the bottom, our main object should be to prevent any rush of water downwards into the top of the drain, bringing earth and sand with it, and thereby choking the duct. We take the stiffest, soapiest clay we can find, place it carefully on the bushes, and trample it down firmly. The firmest part of the original earth taken out of the drain is then returned on to the clay, and the rest thrown in anyhow.

If in bush drains the junctions with the main drain were made with pipes, it would be all the better, and the discharge of the main into the open ditch should be invariably piped for four or five yards upwards: wooden pipes, square or round, will do. The fall towards the mouth of the main where it joins the ditch should be as rapid as possible, to avoid a sudden stoppage from frost.

It may be necessary, in very level land, to use mechanical means to determine the fall of the ground. An ordinary *spirit-level*, mounted on a pole with a spike at the end, is quite sufficient for the purpose, and is used in this way.

Set the level in the middle of the ground to be drained, and placing the eye-sights in the proper direction, turn the screw until the air bubble rests in the middle of the glass tube. An assistant should hold up a rod at the end of the ground in that direction, and mark a point indicated by the observer on the rod. The same operation is gone through at the other end of the ground; and if the two marks agree, the whole piece is on a level. But if the mark at the first station is at 3 ft. 9 in. from the ground, and 4 ft. 8 in at the second, there is a fall of 11 inches from the first to the second station. A very little practice with the level will make any one handy with it; but it is seldom necessary, except to intimidate the workmen by making them believe that the instrument will detect their tricks.

A very small descent is sufficient for the fall in pipe-drains. Cresy, the Civil Engineer, says that one foot in two hundred and twenty yards is enough: $\frac{1}{660}$! The deeper the water in the drain the less fall required: thus, deep rivers only want one foot in a mile In very low lands I have found it necessary, sometimes to take the main a long way down into the ditch to gain a fall; and I have seen, at Longleat, the Marquis of Bath's place in Wiltshire, an iron pipe carried under a mill-stream to take away the water from the drainage of a meadow on higher ground. But in all cases of this sort, the services of a competent engineer should be secured at once; it will be found the cheapest plan in the long run.

ARTHUR R. JENNER FUST.

The engravings of drainage tools, &c., will appear in the January number of the Journal.

Fine Butter and Cheese.

The Sources of Aroma and Flavor.

Prof. Segeloke of the Royal Agricultural College of Denmark, whose experiments and investigations in dairy practice have been of such great value to that country, expresses the opinion that the aromatic principles of butter are due to the partial decomposition of milk or cream and the *development of lactic acid*. In precisely what way this decomposition or development of lactic acid gives rise to the aroma in butter so much sought after and admired by the lovers of butter, is not as yet known, but it may and probably does come from chemical changes in utterly inodorous principles. He says:

"If the temperature of the milk when set for cream be from 10° to 12° centigrade (50° to 54° Fahrenheit) or more, it decomposes, forming lactic acid and several other new principles — among them, aromatic principles; and it needs but to churn the cream to obtain an aromatic butter If on the other hand the temperature of the milk at such time be near the freezing point, the decomposition necessary for the production of aromatic principles is held in check, and consequently the aroma of butter obtained from fresh cream is so feeble that it is not perceptible to persons accustomed to butters prepared as above indicated, in the same way as French butters are made at present. But if it be desired to obtain a more aromatic butter, all that is required is to place the cream in circumstances favorable to *lactic fermentation*, and a few hours will produce the required result.

"In either case, the aroma formed may be more or less agreeable, that all depends on the fundamental principles of the milk, on the quantity of the principles necessary for the formation of aromatic principles that is present, and on the method of manipulation employed.

"In either case, again, the appearance of aromatic principles is accompanied by that of *lactic acid*. Whether the aro-