

the return of the soil into the drains, however well managed, will always, more or less fill up the interstices of the stones. In pipe drainage, we always used $1\frac{1}{2}$ inch—Parkes used 1 inch, but at that size our clay would not stand drying without warping—and I hear from friends in England, that $1\frac{1}{2}$ pipes I laid in 1849 are acting perfectly now. It may seem curious to some, how so small a duct can run off a heavy fall of rain in 24 hours, as it ought to do. I cannot carry in my head the exact figures, but I remember well that the conclusion arrived at by Morton, inspector of drainage for the government loans, was, that a pipe the size of a lady's thimble, kept perfectly clear, was sufficient to bear off all the rain that ever fell in England on an acre of land during 24 hours. The object is, not to carry the water off with a rush, for that would, besides running the risk of choking the duct, draw along many of the most valuable parts of the soil; but to allow the water to sink gently and placidly through the ground, as the water acts in an ordinary domestic filter.

As to the fall to be observed in drains in ordinary fields in this province, any one who can make a ditch can be trusted to make a drain. I cannot help saying, that throughout the French country the ditches are admirably made; and if the people in the Eastern Townships would take a lesson from the *habitants* in this art, they would be none the worse for it. In a loamy soil on gravel, and in a black peaty soil, I have often seen a field of 10 acres dried completely by a four feet ditch at each side.

Where, however, there is a doubt about the level of the bottom of a drain, a few pints of water thrown gently in will often decide the question—where springs exist, their own flow will settle the doubt. The uniformity of the fall can be tested, if thought worth while, by three levelling staves, two of which should be about 2 feet high, and the other extending, with cross-heads 9 inches long. One staff is held perpendicularly at each end of the drain, and the extending one is adjusted and moved up the drain; the head drainer, or manager, can easily see from one end whether the fall has been equally followed, or not. But in practice, these accurate measures will seldom be found necessary; besides, I object *in toto* to a foot being set in the bottom of a drain, unless it is absolutely necessary. Some people are of opinion that the whole length of each drain should be bottomed out before the pipes or other ducts are laid. This is, doubtless, a correct practice during summer, or in dry weather; but when the land is full of moisture, I prefer placing the ducts and filling in, bit by bit, as the drain is dug; and for this reason—the caving in of the earth may, and most likely will, displace the sides of the drain, and it will have to be re-bottomed out—always a troublesome and annoying job, and very likely to be carelessly executed, unless the supervision be much more efficient than it usually is.

Stone drains are so expensive, on account of their necessary width, and the quantity of material required, cartage, &c., that I do not suppose many people will make them. Pipes are, after all, the cheapest in the long run. The only awkward part of the matter is, that they have to be paid for with cash. The price here has always seemed to me extravagantly high, considering that the principal makers were in the enjoyment of an annual "grant in aid" from the Quebec government. I allow that the pipes were well made; but they were twice as heavy as they need be; and that is a matter for consideration when the carriage by rail and road has to be paid for 40 or 50 miles. In Kent, England, within 15 miles of London, the price I used to pay for $1\frac{1}{2}$ inch, of good quality, was \$4 per thousand; and a horse drew, in a cart, a thousand with ease; and good one inch pipes, in Essex, were only \$3 a thousand.

In bottoming-out stone drains, the width should be greater

than for bushes—9 inches, perhaps, would not be too much—and this on account of the difficulty of packing the material. The stones should be as round as possible, and the larger ones should be at the bottom. None more than 4 inches in diameter should be used; they should be rammed down firmly with a peavie's rammer; and some of the smallest should be reserved for the top, to be finished off at last, like the bush drains, with clay, and the firmest part of the subsoil returned first, and well tramped down. A very costly job, and one that I should be sorry to recommend any one to undertake. The same may be said of those ducts of built up stones that I have seen in one or two places in the Province. They take an immense time to make, and, unless they are four square, i. e. with a bottom as well as sides and top, the earth soon rises into them from pressure at the sides, and they are closed for ever.

The drains for pipes are to be opened out as far as the fourth spit, about 36 inches, precisely as the bush-drains, but here advantage can be taken of the *semi-cylindrical tool*, which, being fifteen inches long, enables us to take out a very deep draw for the last one. Generally speaking, the foot need not touch the tool; a side thrust by the hands will be sufficient, unless the ground be very hard and dry, in which case the tramp-pick should precede it. The bottom must be cleared of crumbs by the *semi-cylindrical draw-scoop*, the drainer standing on the fourth spit, and clearing the bottom, as far as he can reach, of the remains of dirt &c., left by the long spade; so that he never sets his foot on the cleared drain at all, but works backwards with his face towards the mouth of the drain, yard by yard, and leaves himself only the pipes to lay and the earth to return. Should any small pebbles be found at the bottom, they must be got out of the way, that the pipes may be well and truly laid; for the slightest crookedness in the conduit forms a dam in no time, and will very likely cause an accumulation of silt fatal to the continuity of the duct. Never allow a drain to be diverted from its straight course. If a rock or large boulder intervene, blow it up—get rid of it some how or other, and pay particular attention to laying the duct in its former site, as the earth is sure to be more tender there, and the pipes will very likely sink and become useless.

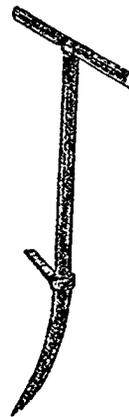


Fig. 1—Tramp-pick.



Fig. 2—Semi-cylindrical spade.

We now proceed to lay the pipes. If the draw-scoop has been properly handled, the bottom of the drain will form a semi cylinder, and the job will be easy enough: the layer, who should be the honestest workman to be found; one who will refuse to place a single pipe in an unfit bottom, should have all the pipes laid ready for him along the side of the drain: straddling across it, with his face to the outfall, he threadles a pipe on his *pipe-layer*, places it gently in its site,