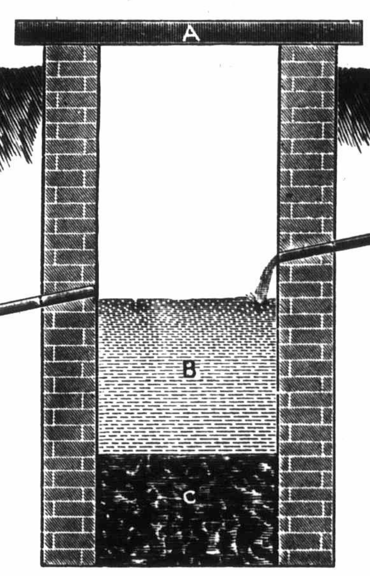
which seem to clash with these methods of obtaining the depth. For example, it is said that, in any case, the drain should be deep enough to escape the frosts; but it must not be forgotten that an important object of drainage is to let the frost down as low as the bottom of the drained soil, and no heaving takes place so long as there is no water to be frozen except that contained within the particles of soil. Again it is said that, in any case, the drains should be deep enough to keep the water table below the reach of the roots of the crop. This must also be taken with a good deal of reservation. No soil can be drained deep enough to lower the water table beyond the depth of the roots of some plants, and it is a fortunate coincidence that in retentive soils, where the drains are supposed to be shallow, the plants can obtain as much nutriment in a depth of say two feet as they can in four feet in a porous soil. The more clay a soil has, the more plant food it will retain, providing it does not become impervious. When the soil and subsoil are uniform, the depth is then measured by the extent of their porosity. The practice to be followed in giving direction to the main depends upon many circumstances. There is only one safe rule, viz., that no rule should be followed. It is very important that the main should be so located as to afford the easiest and most desirable access for the greatest number of laterals entering both sides of the main, if possible; but it is also important that it should contain as few angles and bends as possible. Where the fall is considerable, it may sometimes be well to deviate gradually from a straight line, providing the extra length will save more digging than the extra depth of the shortest cut. However, where the fall is slight, follow a straight line if possible, for the fall from any one given point to another is the same whether the line be straight or crooked, although the fall per foot in the straight line is greater, so that the velocity of the flow is greatly retarded in the circuitous route, caused by the curve, the extra friction, and the extra length. Curved lines also require more tile, making the cost of drainage greater. On the other hand, it must be remembered that if, by the short cut, the drain gets too deep, the drainage will be inefficient, more especially if the soil consists largely of clay.

Next in importance comes the length of the main, the principles, for the most part, also applying to the sub-mains or laterals. This brings us to the discussion of the silt basin, a section of which will be seen in the accompanying illustration. It will be observed that we have supposed it to be made of brick, but stone, or durable wood cut into planks, will answer the purpose very well. We have only represented two sides of the four walls in order that the interior working may be seen. You see that the in-flow pipe or tile which penetrates the wall is a few inches higher than the out-flow pipe, the necessity for which will be readily conceived, but we shall allude to the principle involved when speaking of imperfect outlets. The clear water is represented by B, and the sediment or silt by C. The covering, A, whether made of plank or a flat stone, should fit tightly on all sides and corners of the walls to prevent the ingress of frost, which may damage the tile as well as interfere with the flow, always bearing in mind that good drains are intended to work in winter as well as summer, whether the ground is frozen or not. Where greater security from frost is desired, it is advisable to use hard-burnt tile or piping, instead of ordinary tile, for several feet distant from the silt basin. The surface of the ground is represented at D. D. The size and depth of the silt basin are immaterial, but it is usually made from 12 to 24 inches in diameter, and the depth below the pipe should be such that the basin will not require cleaning out too frequently. The silt may be removed by means of a dipper. It will readily be perceived that the deeper the basin from the out-flow pipe, the cleaner will be the outflowing water, and hence the greater the security of the drain, as well as of the outlet.

The original intention of this basin was merely to gather the silt, and to ascertain, when the drain became plugged up, whether the obstruction was above the basin or below. If a peep be taken into the silt basin and it is found that the inflow pipe is running, the outflow being obstructed, the ascertaining of the obstruction must then be confined to the portion of the



SECTION OF SILT BASIN.

drain lying between the basin and the outlet. From this point of view, (although it is still advisable to construct silt basins in long drains) the basin is for the most part an apology for deficient skill and bad workmanship in the construction of the drain; for if all the operations be properly conducted, and the size of the tile be such that the drain will occasionally run to its full capacity, there will be very little danger of obstruction.

There are other considerations, however, which render the use of silt basins very desirable, and sometimes absolutely necessary. One portion of the main may naturally require a different fall from another, in which case a silt basin will produce an evener depth of drain. When the upper portion of the drain has a much greater fall than the portion below the silt basin, see that the latter will discharge the water as rapidly as the former will flood it into the basin, otherwise the water level may remain near the surface too great a length of time, and if the head of the drain is higher than the top of the silt basin, the latter may overflow. The silt basin is specially useful where it is necessary to make sudden curves or sharp angles in the direction of the drain. Indeed, it may sometimes be necessary to lead two or more mains into one silt basin, making only one outlet.

Experiments With Potatoes—Potato Rot—Profits and Losses on Fertilizers.

(A Lecture delivered by W. A. Macdonald before the Middlesex Agricultural Council.)

No 1.

Mr. President and fellow-members: At the special request of your Board of Control I have brought with me a tabulated statement of the results of my experiments with potatoes, showing the percentage of gains and losses which I have made on the different manures and fertilizers applied, and their action in relation to the potato rot. I have also made a number of experiments with vegetables and some farm products, but those in relation to potatoes will occupy the limited time at our disposal. I do not claim originality in my system of investigation, for this has been the laborious efforts of half a century, in which the greatest agricultural talents of the age have been employed; but I claim to have the most accurately conducted experiments on the action of various commercial fertilizers upon the potato rot. In one important feature, however, I have moved out of the rut of other investigators, viz., the business calculations, without which I consider experiments to be of little practical value. I do not wish you to regard my experiments as conclusive, for they should be repeated on different soils and in different seasons, but my earnest desire is that they should awaken in you a spirit of investigation which is absolutely necessary to true agricultural progress. In order to effect this result, we must go back to the first principles; all the known conditions must be fully weighed, and it should not be said that a certain course is theoretical simply because it does not at once fall within the bounds of our understanding. If one single condition is omitted from our consideration, the whole experiment may be worse than useless, for it may lead us to adopt false methods. I rejoice that your worthy President is so well read in the science of farming, as well as being one of the oldest and most successful farmers in the County of Middlesex, and I tremble lest he too ardently expose any error that may accidentally fall from my lips.

Last spring, while loitering in the suburbs of London I observed a neglected plot, and being struck with the remarkable evenness of the soil, I resolved upon converting it into an experiment station. Fortunately, the land was for sale, and upon examination of the subsoil, I was strengthened in my conviction as to its adaptability for the purpose mentioned. Upon a mechanical analysis I found that it contained abou 60 percent of clay, and it therefore borders on a loam and a clay loam. I ascertained that alternate cropping and neglect had formed the system of rotation for over 30 years, so that I found myself face to face with the task of commencing to restore a worn-out soil. Not being able to get a pedigree of the cropping, I was forced to conduct experiments as to what constituents of plant food the soil was most deficient in. I staked off the third part of an acre, embracing a portion that presented the same aspect to sun and wind. This plot made 33 rows 145 feet long and 3 feet apart, each row therefore being the hundredth part of an acre.

I planted the potatoes on the trench system, digging the ground the depth of the spade (one foot) and two spade-widths. This left a mellow