

still the greater certainty of tightness and correct grading, if due only to the better class of workmen by whom it is done, is a strong argument in its favor. After reaching solid ground that has not been disturbed in excavating for the foundation, a *carefully laid and rigidly inspected* earthenware drain is to be preferred. After the drain passes inside of the foundation wall it is better, where it is not necessary to connect with fixtures in the cellar, that it should be carried in full sight, along the face of the cellar wall or suspended from the floor-beams, to the point where it is to turn up as a vertical soil pipe. This is advisable because here, as much as anywhere else in the house, it is important to be able to inspect the joints, and to know always the condition of the work. If, however, it should be necessary to make connection with a water closet or other fixture in the cellar, it is better that the main channel should run under the floor to or near the location of such fixture, in order that all or nearly all of its length may constitute a part of the main line, thoroughly flushed and thoroughly ventilated, like the rest of the system.

THE SOIL-PIPE.

It is a generally accepted rule, and a good one where space suffices, to use no short turns—technically, "T branches" and "quarter bends." Two one-eighth bends, or a Y branch and a single one-eighth bend, give a more gradual and therefore better change of direction. So, in the attachment of water closets to vertical soil pipes, it is usual and better to make the connection with Y branches. Where space does not suffice, however, a half Y answers a sufficiently good purpose, and even a T branch (right angles) is less objectionable than it was when flushing was less copious than it now is. The soil-pipe throughout its whole length, horizontal as well as vertical, should be so secured with hangers and clamps or hooks and with supporting posts that it will be rigidly fixed in its position. From the beginning of the work, every joint should be made with a view to being tested under hydraulic pressure. If the workman has this in view, the test will generally discover few leaks. As ordinarily made, especially where the whole circumference of the pipe is not easily accessible to the calking tool, a test will

almost invariably disclose serious leakage. In every case the test *should* be made, and every semblance of a leak should be calked until thoroughly tight under pressure. In making this test, the simplest way is to close all openings into the pipe with disks of india-rubber compressed between two plates of iron forced together with a screw. Such plugs can be fastened so tightly as to hold a head of fifty feet. There is no special advantage, however, in applying this force; for if joints are to leak at all, they will leak generally under a head of a few inches, and always under a head of a few feet. It is generally most convenient to test the vertical pipes story by story, the plugs being inserted through the water closet branches. Another satisfactory test which may be applied after all fixtures are attached is made with an air-pump and pressure-gauge, such as gas-fitters use. If the gauge stands firm even under a slight pressure for an hour together, the work may be accepted as tight. The principal drawback is that, if the work is not tight, it is much more difficult to locate a slight leak than when the water test is used. I think it may be accepted as a well-grounded rule that no prudent owner should receive and pay for his plumbing work until all of the iron waste-pipe has been tested, by one or the other of these methods, under the personal observation of the architect or his plumbing expert. There is probably no occasion to fear that work once made tight will develop leaks for many years, the tendency to rust after a time, even with tar-coated or enameled pipe, being rather to close such slight leaks as may exist..

There are two grades of soil-pipe known to the trade, "common" and "extra-heavy." If common pipe has sufficiently strong hubs to stand heavy calking, and if the *outer and inner circumferences are concentric*, there is no reason why it may not be trusted for very long service; but it is difficult to maintain the core in a perfectly concentric position, and even in the best pipe there is generally a slight difference of thickness between one side and another. A very slight difference is a very serious matter in common pipe. In extra-heavy pipe, unless the eccentricity is very obvious, even the thinner portion will be thick enough for safety. This thicker pipe, however, is sometimes