

## Water Supply and Purification



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The general question of water supply is an extremely wide one. The question of purification is no less wide. It would be impossible for me to do justice to the subject within the limits of a single paper. If I attempted to deal with the various headings into which the subject may be divided, such as available rainfall and other sources of supply, (such as direct collection of rainfall, springs, wells, streams, rivers, lakes, and storage reservoirs, and the different values to be attached to shallow wells as against deep wells, the various methods of water purification by means of chemical re-agents, slow or rapid sand filtration, sterilisation, etc.), I feel sure that such a dissertation would only weary you, and my observations would be so incomplete that no definite data could be conveyed.

I have, therefore, as it were, mentally reviewed the whole subject with a view to selecting one or two particular phases of the problem of water supply which I consider are more particularly of practical value as effecting general economy and efficiency. The subjects which I have selected are: — "Tuberculation and growths in water mains—their prevention and removal," and "Purification of Water by Mechanical Filtration." Even to treat these two subjects conclusively would present a gigantic task, — no one expects however, that more than the salient features can be touched upon in a short paper.

### Tuberculation and Growths.

These may be divided as follows — (a) Rust, (tuberculation), (rust nodules); (b) Incrustation due to alkalinity; (c) Biological formations due to organisms; (d) Sedimentary deposits. All of the above, either separately or together, frequently occur in water mains. They are the cause (apart from extended distribution) of the gradual diminution of pressure so common in our water systems. They are the further cause of the gradual and sometimes enormous increase in power required to maintain necessary pressures.

Mr. Desmond Fitzgerald (Transactions of the A. S. C. E., Vol. 15, p. 337, 1886) states: "Great attention is paid by hydraulic engineers to the designing of dams,

aqueducts, reservoirs, etc., structures connected with the source of water supply; but, the question may well be asked: "Is proper attention paid to the pipe or distribution system?" Experiments and formulas we certainly have of the flow of water through pipes, but the writer is inclined to believe, as the result of observations, that when the water has once been turned into a pipe system, little more attention is paid to the condition of the pipes. Sometimes, it is true, small pipes fill up entirely, and then the specimens are exhibited showing the growth of tuberculation. Again, the water becomes bad in one street whilst it is good in the adjoining neighborhood, and, the result is attributed to some mysterious agency. It is believed by the writer that one of the great steps in advance that will be made in years to come in the designing of pipe systems will be the introduction of facilities for cleaning out the pipe at stated intervals of time. This will be found necessary, not so much for restoring the normal capacity of the pipes as for maintaining the purity of the water."

The above statement was true twenty years ago when it was made, and it is equally true to-day. Numbers of water systems can be pointed to, where the water as delivered at the tap is more impure than the water at the source, and where it becomes, year by year, more difficult and expensive to maintain satisfactory pressure owing to the reduction of the diameter of the pipes.

Although much attention has been given to the subject of growths in water mains and their removal in Great Britain, comparatively little has been given in this Continent. Where attention has been given, however, the results have provided the utmost satisfaction, both from an economical and efficiency point of view. Electric Engineers are careful to provide inspection boxes on their transmission lines, and even sewers are provided with manholes which allow of inspection; but, as a rule no means are provided for the general inspection of the condition of water mains, or facilities provided for cleaning out even the dirt which will accumulate apart from the removal of rust and other growths.

Before going into the question of the removal of tuberculation and growths it may be well to shortly review what knowledge we have of these incrustations.

Tuberculation is the term applied to rust or oxide of iron which forms on water mains, principally in such mains where pipes have not been originally properly protected with some coating mixture. Small pipes may become completely choked with rust. With large pipes, however, there appears to be a limit to the thickness of rust, an inch and a half of incrustation provides a protection to the body of metal forming the pipe. Rust incrustation in pipes commences as a rule as small specks appearing at points where the protective coating leaves the pipes exposed. The specks grow rapidly in the form of nodules like limpets, gradually covering the whole internal surface and eating under the protective coating which they scale off and destroy. These limpet shaped cones, or rust tubercles, as they are called, are generally hard on the surface and soft inside, and are easily removed by scraping. The rust is the result of a combination of the iron with the air which is always present in water; it occurs equally with filtered or unfiltered waters, and grows at greater rapidity with soft waters than with hard. In fact under certain hard waters rust tuberculation is practically unknown, even with uncoated pipes. The tendency to rust growth with soft water is due not to the degree of softness or hardness, but due to the fact that most soft waters are of surface origin and contain vegetable acids, such as carbonic acid due to organic fermentation. One thing is certain, and that is