

**WATER SOFTENING AND
PURIFICATION: THE SOFTENING
AND CLARIFICATION OF HARD
AND DIRTY WATERS**

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Water Softening and Purification: The Softening and Clarification of Hard and Dirty Waters by
Harold Collet

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HAROLD COLLET

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WATER SOFTENING

AND

PURIFICATION

*THE SOFTENING AND CLARIFICATION OF
HARD AND DIRTY WATERS*

BY

HAROLD COLLET

(STANHOPE WATER ENGINEERING CO., LIMITED, LONDON)



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WATER PURIFICATION.

CHAPTER I.

WATER SUPPLIES.

Pure water is sought for in the arts and manufactures, that is to say, water not only clear and free from matter in suspension, but also as devoid as possible of dissolved impurities. In both respects distilled water would be the ideal water for manufacturers. And in fact, where, by the condensation of steam after use, distilled water is produced, it is frequently collected for employment in the works. Especially is this the case where the buildings are artificially heated by steam, but in almost every case there must be a considerable loss by leakage, so that the condensed steam, if in itself suitable, is not sufficient in quantity to supply the boilers.

Rain water stands next in purity, but the area from which it can be conveniently collected is so restricted in all cases that its extensive use is not possible. It can generally only be collected from the factory roofs, and as these are always covered with soot, dust and similar impurities, the rain water becomes contaminated, and sometimes even slightly acid. Rain water from

roofs in manufacturing towns is, during at least the first portion of a long continued downfall, very hard, sometimes as hard as 25 or 30 degrees, but after a time this sinks to about 3 degrees. The meaning of degrees of hardness is explained later on.

Rain water and distilled water being unavailable, manufacturers have to depend either upon the town supply or upon the water they can draw from springs, wells or streams. Such waters are generally what is called hard.

Hard water contains in solution the bicarbonates, sulphates, chlorides or nitrates of lime and magnesia. The bicarbonate of iron, alumina and silica are also generally present in natural waters, but seldom in such proportion as to be of practical importance, rarely, in fact, amounting together to more than one grain per gallon.

Hardness is frequently described as being of two kinds, temporary and permanent. The temporary hardness is that due to the bicarbonates of lime and magnesia, and is so called because *prolonged* boiling will, by driving off part of the combined carbonic acid, cause the precipitation of the greater portion of the above impurities, leaving the water proportionately softer. The permanent hardness is due to the sulphates, chlorides and nitrates of lime and magnesia, and is not diminished by boiling at atmospheric pressure. But this distinction between temporary and permanent hardness fails altogether as soon as the water enters a boiler, for at the very high tem-

perature of a boiler under steam pressure, the sulphate of lime becomes insoluble, and the chloride of magnesium, inert while cold, becomes actively corrosive.

Temporary hardness can be removed by means of lime, generally but not always to the same extent as by boiling, and much more cheaply. Boiling costs not less than 1s. per thousand gallons, while lime will soften the same quantity for less than $\frac{1}{2}d.$

The impurities of water are of course not limited to the substances in solution. Very often water holds in suspension mineral and organic matters which give much trouble and are difficult to get rid of. But such visible impurities are less injurious than those in solution, and consequently invisible and apt to be neglected. It is a mistake to judge a water by its appearance alone. It must not be concluded that a water is suitable for use simply because it is clear and perfectly colourless. Clear bright water is frequently obtained at considerable expense, which gives all sorts of trouble in use, while a dirty looking stream close by might have yielded a water better suited to the purposes of the user.

Many manufacturers use the water supplied by the water companies, in spite of high prices, their belief generally being that it must be the best procurable. And for drinking it almost always is the best, for when the sources of town supplies are chosen, the chief object kept in view is that it shall be drinkable and free from organic taint. But for manufacturers it is frequently much inferior in usefulness to the surface streams and