What shall we drink? : being a few hints upon the importance of the tempeature of potable or drinking water / by Samuel B. Goslin ; to which is appended reprints of the papers of Baldwin Latham... on the temperature of town water supplies.

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J. B. Townsend.

WHAT SHALL WE DRINK?

BEING

A FEW HINTS UPON THE IMPORTANCE

OF THE TEMPERATURE OF

POTABLE OR DRINKING WATER

BY

SAMUEL B. GOSLIN, F.M.S., &c.

TO WHICH IS APPENDED REPRINTS OF THE PAPERS OF

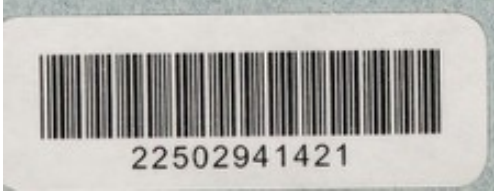
BALDWIN LATHAM, Esq., C.E., F.G.S., F.M.S.

ON THE TEMPERATURE OF TOWN WATER SUPPLIES,

Read before the British Association for the advancement of Science.

1883.

COWELL'S STEAM PRINTING WORKS, IPSWICH.



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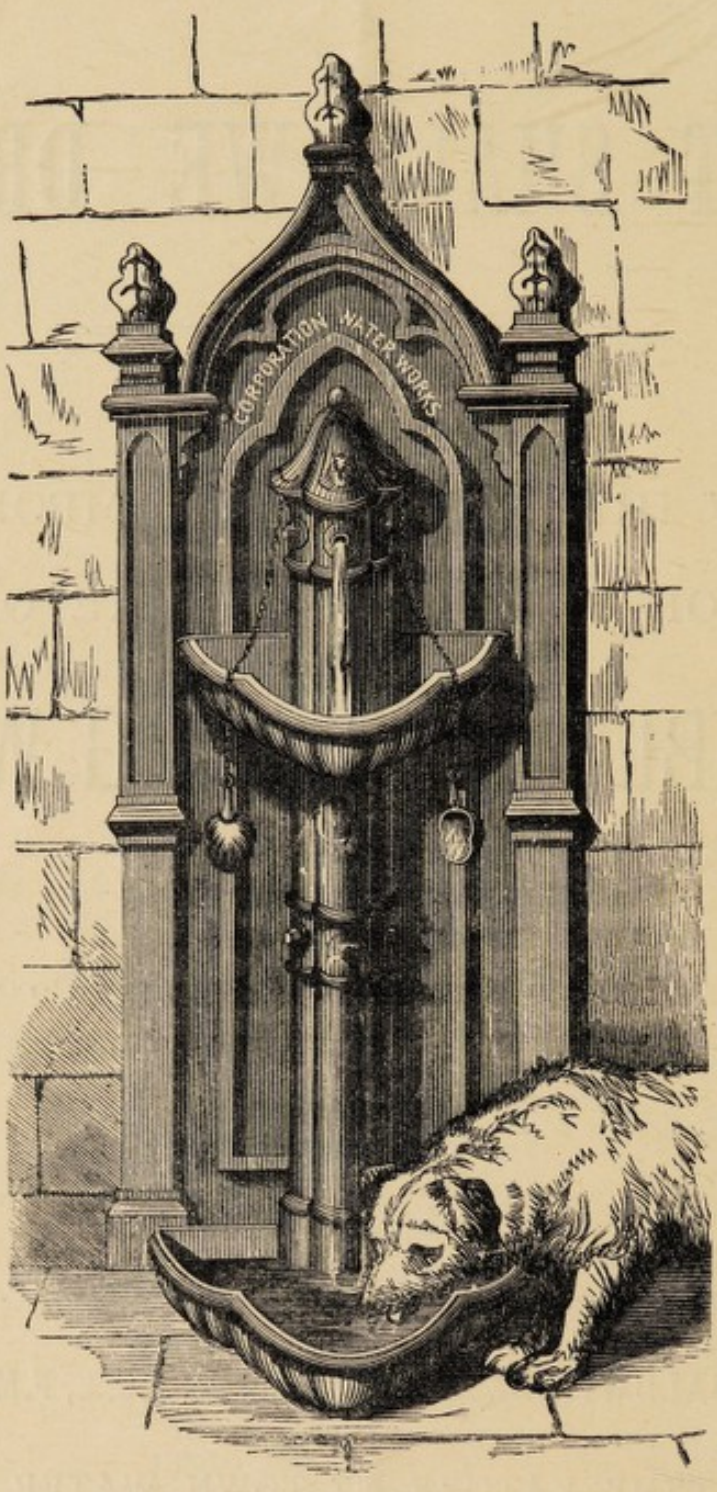

CORPORATION WATER WORKS

WHAT SHALL WE DRINK?

A few Hints on the Temperature of Potable Water.

IT may be as true to-day, as it was in days long past, that the talents which might be devoted to the more sublime subjects and studies, connected with the well-being of mankind, collectively and individually, have been, and are directed to those matters which concern his feeding propensities, and the drinking desires of his race; in the continued and eager enquiries, for those things which are best, to satisfy the longings proclaimed in the words, "What shall we eat," and "What shall we drink;" but whilst it may be thus far true, that studies and time have been so directed, yet it cannot be hidden from the mind of every sanitarian, and well wisher of the human family, that from the very study of these two subjects, disease, pain, sorrow, and poverty have been frustrated and prevented, at the same time that good health has, with greater prosperity and happiness, been secured.

To obtain both freshness and freedom from adulteration in connection with food, the purity of water and nourishing beverages, has been the aim, for a considerable period, of the leaders of a certain class of our scientific thinkers, our social or humanitarian benefactors, as well as our legislators; which, happily, has been the means of attaining great results.

The facility to procure, the constant reports published of the Analyses of water and other liquids, as well as solids, has given the means to check, what in many cases would have led to disaster and loss to many communities, as great, perhaps, as would have resulted from neglected drainage or a polluted atmosphere.

However much science, practice, and publications have been brought to bear on these particular topics, yet there remains one question at all events in reference to drink, which needs due consideration, and the practise of some few simple precautionary measures, to effect what has been proved to be desirable in the interests of the public good, involved in the words—

WHAT SHALL WE DRINK?

but whilst the precise figures of the relative degrees of nutrition, which are found to exist in the varied decoctions, infusions, or mixtures of artificial production, or the discussion *pro* and *con* upon the utility or bane in the use of alcohol, may be left; there can be but one conclusion upon the question of water, that it is the best of all beverages for the thirsty, if it can be obtained as it should be, primarily, in a state of purity, and secondly, if it can be found and used at a "proper temperature."

A great deal has been said and written upon the results, and statistics have been both gathered and scattered broadcast, in reference to diseases caused by impurities taken into the human system, through the medium of beverages, and particularly through water, not indeed without beneficial effects, in causing greater care in examination, greater filtration before its use, and more precise methods taken to ensure its purity by Water Companies, and other bodies charged with the responsibilities of supplying it to both large and small communities, yet, as to the particular temperature at which it should be delivered for potable purposes, the advantages of comparative statistics, have not been so used as they should have been, for the public good, for whilst pure water, it may be granted, is the best, or among the best of beverages, yet, if it be taken at a temperature unsuited to the conditions of the human body, or if a moderately pure water be taken, without any bad results at one temperature, the most lamentable results have occurred, and do occur by an increase or decrease of its temperature, on the one hand by giving and fostering the germs of life or disease, which are hidden among its minute molecules, and on the other by an undue reduction of the temperature, or the sudden absorption of caloric from the internal parts of the body, when it may be in a state of heat above the normal condition.

Wonderful indeed as are the effects of temperature, upon the health and cultivation of plants, through the medium of water,—being fed with water above or below certain limits of temperature they sicken and die,—none the less are they upon all animals, including man, whether it be by external application, or by the results of its use as a beverage.

"Give me a glass from the crystal spring," or a "cup of cold water only," may often be the very acme of desire following the self-imposed query of "What shall we drink," yet how often is it that the cold water so desired, is not even cool, whilst it contains the expanded germs of disease set in motion and vitality, by the warmth of the atmospheric and surrounding conditions.

Those persons who have been observant of the manners and customs in the feeding occupations of the lower but warm-blooded animals, have not failed to notice that in many of them there is a decisive repugnance to pollution, a marked dislike to heated liquids above a certain pleasant temperature, and a shyness of frigidity in connection with water, their natural and common beverage. Those results which have been obtained, by experimental enquiries, into the influence of physical agents on warm-blooded animals, have demonstrated such uniformity, that it has been fairly and consistently concluded, that the like results are to be looked for, when such experiments or conditional circumstances are applied to man; indeed, it is the fact, that although man may stand alone in the gift of intellect or understanding, above other animals, yet his life and existence are subject to the same laws and operations, which result from differences of temperature. Man is not less subjected than other animals to the necessities of a constantly renewed supply of air, neither has he a privilege removing him from the need of pure water, or, in the refusal of that element, at a temperature unsuited to his bodily condition,—this latter point cannot be better illustrated than by the facts, that what is termed warm water, is constantly administered as an emetic; hot tea in many cases produces sickness, and that when what is termed cold water, is taken on a summer day after exercise into the over-heated body, when only some few degrees of heat have been added to the blood, by the exercise,

distressing disorders are produced which, in many cases, are tedious to deal with.

That the beverages of man, and especially when water is so taken by him, should be at a moderate temperature, has been proved by a more conclusive deduction, than that of the simple analogy of animal customs or propensities; this fact is well worthy to be inculcated and remembered, as tending to the alleviation and freedom of the human family, from the dire results of diarrhœa and cholera, whilst the well known condition of the even temperature of the human body, whether placed as it has been, in a temperature of 100°, 176°, 210°, or 264° Fah., or in the Northern climes, would point conclusively, that an even temperature in water taken as his beverage would be the most suited to his condition, and ensure freedom from unpleasant results.

If, however, these important conclusions were to be founded upon simple deductions, some doubts might exist as to their accuracy, and the subject would be fairly designated as "being questionable," but which, when based as they have been on a most elaborate compilation of statistics, it cannot be assailed.

The papers read before the British Association in 1879 and 1880, by Mr. Baldwin Latham, M. Inst. C.E., F.G.S., F.M.S., have shown beyond controversy that diarrhœa and cholera became epidemic in certain districts, when the water supplied by Water Companies was at a temperature beyond 62° Fah., and that these epidemics do not, as it has been often supposed, depend upon atmospheric temperature alone, and further, that if means are adopted to prevent an increase of the temperature of fairly pure potable water beyond that point, these diseases do not become epidemic, indeed, the actual death-rates recorded in districts supplied from the main pipes of water-works, where the water has been above the most desirable temperatures of say from 50° to 55°, and the artesian well and other waters have been at that average of temperature in the same periods, in the same districts, are significant and most conclusive. These papers deserve and should be read by every medical officer, sanitarian, and member of our Local Boards, so that at least some provision should be made to prevent evils which may be avoided.

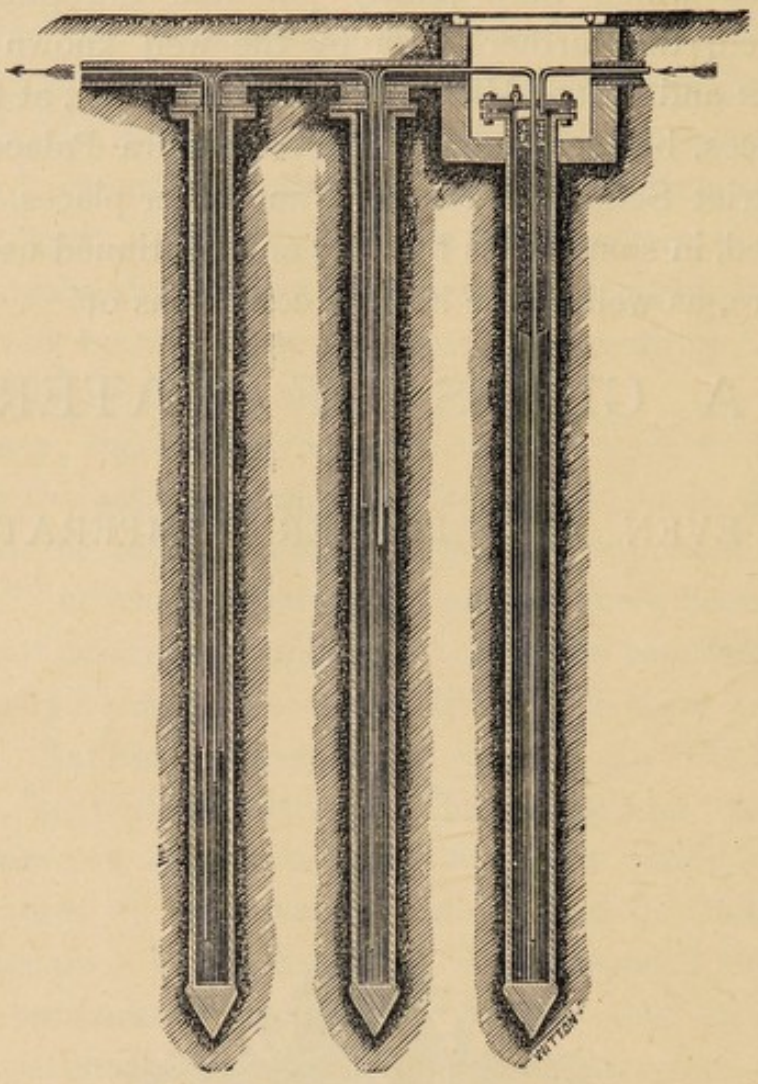
If, however, we were to be left in the unfortunate position of having no reliable remedy, it would be both lamentable and strange, but as the same gentleman has not and did not stop at the simple record of the facts given with the statistics, but in connection with Professor J. T. WAY, not only tried, but found and fully tested an appliance which they jointly patented the public may be congratulated, the further trials by the well known Dr. B. W. RICHARDSON and JAMES MANSERGH, M. Inst. C.E., at their respective residences, besides those at the Alexandra Palace, the North Surrey District Schools at Anerley, and other places, have further demonstrated, in some cases by daily and continued use, the luxury and pleasure, as well as the healthy conditions of

A GLASS OF WATER

AT

AN EVEN AND PROPER TEMPERATURE.

LATHAM AND WAY'S
PATENT WATER TEMPERING TUBES.



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TEMPERATURE OF TOWN WATER SUPPLIES*

BY

BALDWIN LATHAM, C.E., M. INST. C.E., F.G.S., F.M.S., &c.

TEMPERATURE has a considerable amount of influence in rendering a supply of water palatable or otherwise. An increase of temperature beyond about 55° renders water vapid and insipid, and favours certain organic developments that render some water unwholesome.

The supply of water as it exists in geological strata such as the chalk, new red sandstone, and other geological formations, possesses *in situ* a marked uniformity of temperature throughout the year. It is on this account that some of the most distinguished men of science strongly recommend a public supply of water from the chalk, new red sandstone and other water bearing strata, as being more agreeable for dietetic purposes than the water-supply taken from other sources liable to considerable changes of temperature.

It has been generally assumed that water taken from superficial sources, such as from a river or from impounding reservoirs, contrasts unfavourably with regard to its temperature with water supplied from wells and springs. It will be generally admitted that the water in deep wells has a pretty uniform and agreeable temperature throughout the year. On the other hand, the water supply of rivers or impounding reservoirs has a fluctuating temperature, varying with the season of the year, being warm in summer and cold in winter, while the water in deep wells is always much colder than the ordinary temperature of summer, and is warmer than the ordinary temperature of winter. The water of shallow and polluted wells is often used for dietetic purposes, in preference to the supply of pure water laid on to a house, in consequence of the agreeable and refreshing temperature of the well supply.

That changes of temperature do influence water to a considerable degree is clear, as every rise of temperature in water liberates air and other gaseous matter, and it is on this account that water stored in the cistern of a house attracts to itself impurities, when again cooling down, and is thus rendered foul and unwholesome. It is a singular fact however, that if the mean temperature of the water, as derived from a river or from a well, throughout the year, is taken, there is very little difference in the mean temperature, but there is very considerable difference in the range of temperature, that is, between the highest and the lowest temperatures observed during the period. The temperatures of water at its source, whether it be in a well or a river, and the temperature of the water as delivered to the house of the consumer are, however, totally different, and this is a point which has hitherto been overlooked.

* Being a Paper read before the British Association, at the Sheffield Meeting, 1879.

The Author has made a number of observations of the temperature of water, both at its source and as delivered to the consumer, and these results show, that whatever the source of water-supply, there is very little difference in the temperature when the water arrives at the tap of the consumer. The water at its source may have a very uniform temperature, such as is possessed by supplies taken from the chalk or the new red sandstone, or it may have considerable range of temperature, as in the case of water taken from an impounding reservoir or from a river, but, notwithstanding these differences of temperature, the water as delivered, will be found to be possessed of a temperature pretty nearly that of the temperature of the ground throughout the year, at the depth at which the distributing mains of the district are laid. In summer, all water mains tend to either raise or maintain a high temperature of the water-supply, while in winter they act as refrigerators, and cool or raise the temperature of the supply, according to whether the water at its source possessed a higher or a lower temperature, than the temperature of the ground at the depth at which the mains are laid.

For upwards of 2½ years the Author has daily observed the temperature of the chalk water, as supplied to his house at Croydon, and has also noted the temperature of the water in the Water Works wells before it has been pumped for supply. In making the observations at the Author's house, the water was taken from a tap in direct communication with the street main, and in every case the water was allowed to flow from the tap for a sufficiently long time or until the temperature had become uniform. It should also be noted that the water-supply of the district has been constant during the whole period over which the temperatures given in this paper refer.

Taking the results of the last twelve months, commencing July, 1878, to the end of June, 1879, a period which embraces some of the hottest and the coldest weather we have experienced for some years past, it was found that while the temperature of the water in the wells, before being pumped for the supply, gave an average temperature throughout the year of 50·96° Fahrenheit, the range of temperature, or the difference between the highest and the lowest temperatures, was but 0·64°, the highest average temperature for the month being 51·28° in September, and the lowest 50·64° in March, the highest average temperature of the water for the month delivered at the Author's house direct from the mains was 62·25° in July, and the lowest was 41·11° in January, showing a range of 21·14° while the average temperature throughout the year was 50·37° being only 0·59° under the average of the water in the wells, while the difference in the range was 20·5°. This same water, when stored in an exposed cistern at the Author's house, was found to possess an average temperature of 68·71° in July, and 40·66° in January, showing a range of 28·05°. The average temperature in this cistern throughout the year was 52·03° being a difference of but 1·07° from the average temperature of the water in the wells.

The underground temperature has also been observed at various depths by the Author, and a thermometer in a tube 2·75 feet in depth during the same period was found to give an average temperature throughout the year of 48·77°, the greatest average being for July, 63·79°, and the lowest 37·04° for January, showing a range of 26·75°. Another thermometer in a tube 4·75 feet deep gave an average temperature throughout the year of 49·41°, the greatest average temperature being in August, 60·89°, and the lowest in November, 40·4°, showing a range of 20·49°. The water-mains in Croydon are laid, as a rule, at a level between the depths of the two tubes, the temperature of which has been before given; it will therefore be seen that the temperature of the chalk water at Croydon, is modified by the temperature of the ground in which the mains are laid, and at which it flows to the consumer.

During the same period daily observations of the temperature of the water supplied at the Author's offices in Westminster were taken, the supply being derived from the Thames, through the Chelsea Water Co.'s mains, by the intervention of a cistern. These experiments show that the average temperature throughout the year was 51·04°, differing but 0·67° from the average temperature of the chalk water as delivered direct from the mains at the Author's house at Croydon, and differing but 0·08° from the temperatures of the chalk waters within the wells at Croydon. The range of temperature was found to be 24·69°, being highest in July, 65·29°, and lowest in January, 40·6°.

The Author has also from time to time, at different places, observed, that in towns drawing their water supply from impounding reservoirs, this same marked difference of temperature, and that the temperature of all water, whatever its source, is influenced in every case, and at every period of the year, by the temperature of the ground, and by the depth at which the distributing mains are laid, and consequently, the temperature of water furnished from Water Works, and supplied to the consumer, is totally independent of the temperature of the water at its source.

Table showing the Temperature of Town Water Supplies, 1878 and 1879.

DATE.	Average daily temperature in Water-Works Wells, Croydon.	Average daily temperature of Water supplied from Mains, Croydon.	Average daily temperature of Water in Cistern, Croydon.	Average daily temperature of ground at 2.75 ft. deep, Croydon.	Average daily temperature of ground at 4.75 ft. deep, Croydon.	Average daily temperature of water supplied at Westminster.
1878.						
July	51.07	62.25	68.71	63.79	59.86	65.29
August ...	51.22	61.93	62.96	62.90	60.89	63.87
September ...	51.28	58.62	59.46	59.51	59.08	58.87
October ...	51.23	55.22	55.76	54.57	55.49	55.18
November ...	51.10	46.71	46.53	44.58	48.28	45.46
December ...	50.91	42.78	42.51	38.71	43.02	41.26
1879.						
January ...	50.82	41.11	40.66	37.04	40.44	40.60
February ...	50.73	41.81	43.48	38.45	40.40	42.31
March... ...	50.64	43.34	45.66	40.95	41.98	44.96
April	50.80	47.09	47.41	44.24	44.31	46.76
May	50.76	48.85	51.50	45.18	46.96	50.36
June	51.03	54.74	59.80	55.42	52.22	57.65
Total 12 months	611.59	604.45	624.44	585.34	592.93	612.57
Average ...	50.96	50.37	52.03	48.77	49.41	51.04

TEMPERATURE OF TOWN WATER SUPPLIES*

By BALDWIN LATHAM, M. Inst. C.E., F.G.S., F.M.S.

IN a paper read last year before this Association,† the author gave the results of a series of experiments, extending over a considerable period, of the temperature of town water-supplies, and referred to the influence of the temperature of town water upon public health.

In the communication referred to, it was shown that the temperature of water, as delivered through the water mains to the house of the consumer, was totally independent of the temperature of the water at its source, and that the temperature of the water-supply was governed, to a great extent, at all periods of the year, by the temperature of the ground, at the depth at which the water mains were laid.

It was further pointed out that the influence of temperature upon water-supplies had a very marked effect upon certain classes of disease, especially diarrhœa and cholera, and that it was not until the temperature of the water reached about 62° that these diseases became epidemic in a district.

In order that it may be shown that it is not the effect of increase in atmospheric temperature that is instrumental in the propagation of diarrhœa and cholera, but that these diseases are governed by the changes which take place in water, when its temperature is increased, it may be pointed out that, in districts in which the source of water-supply is not liable to increase of temperature by reason of the arrangements adopted for its distribution, summer diarrhœa does not become epidemic. For example, we will take the three years, 1877, 1878, and 1879. Both the years 1877 and 1879 (especially the latter year) were years in which town water did not reach its most dangerous temperature, but in 1878 the town water-supplies arrived at a high and dangerous degree of temperature.

The water distributed under the system of constant supply at the author's house in Croydon, when drawn direct from the mains, had, in 1878, a maximum of 64·8° ; and, in Westminster, the water supplied by the Chelsea Water Company reached a temperature of 68·4° ; while water taken from a cistern in Croydon had a maximum temperature, in the same year, of 71·5°. In 1879, the highest temperature of the water in the cistern at Croydon, already referred to, was 67° ; the highest temperature of the water, as delivered from the mains in Croydon, in 1877, was 61·7°, and, in 1879, 61.7°; whilst in Westminster, the highest temperature of the water, in 1879, was 64°.

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* Paper read before the British Association, Section G, Swansea, 1880.

† Reprinted from the Society of Arts' Journal.

The deaths from diarrhœa in Croydon in the three years, 1877-9, were as follows :—1877, .48 per thousand living in the district ; 1878, 1.00 per thousand living in the district ; 1879, .34 per thousand living in the district. In London the deaths from diarrhœa were :—1877, .70 per thousand living in the district ; 1878, 1.02 per thousand living in the district ; 1879, .52 per thousand living in the district.

If these death-rates are compared with the death-rates of districts in which the water is principally taken direct from wells, it will be seen that in these latter districts the death-rates are very much lower, as for example, in the districts of Mitcham and Merton, which are partly supplied with water from artesian wells (of an uniform temperature of about 54·6°), partly by surface wells, and partly by the Lambeth Water Company. These two districts have a population, at the present time, of about 11,000 persons. In 1877, the death-rate from diarrhœa was ·39 per thousand, in 1878, ·47 per thousand, and in 1879, ·46 per thousand. In Beddington, which is also principally supplied from local wells, in 1877 the death-rate from diarrhœa was ·20 per thousand, in 1878, ·49 per thousand, and in 1879, there were no deaths whatever from diarrhœa. In the three years, 1877 to 1879, in the districts of Mitcham and Merton, there were 14 deaths from diarrhœa recorded, of which 10 occurred in roads supplied with water by the Lambeth Water Company, and four in roads supplied with water from shallow and artesian wells.

In order to further show that the temperature of water has an influence on health, the author placed upon a map the whole of the deaths from diarrhœa which have occurred in Croydon during the 11 years, 1869 to 1879, inclusive. The water-supply of Croydon proper is taken from wells, the range in the temperature of the water of which has not exceeded 1·15°, its highest recently observed temperature being 51·9°, on the 19th June, 1880, and the lowest temperature, 50·75°, on the 15th December, 1878. The water, after leaving the wells at Croydon Water Works, is pumped to a summit reservoir, from which it is distributed to the town. In order to raise the temperature of the water, it is necessary for it to flow a certain distance through the distributing mains before its temperature becomes affected. It is a significant fact that, in the districts within a mile of the reservoir in which the water is always at its coldest temperature in summer, during the whole period of 11 years, not a single death from diarrhœa has taken place in the neighbourhood of the leading mains, but the distribution of the deaths occurs in the most remote and lowest portions of the district, or those which are naturally subject to the greatest changes in the range of temperature of the water-supply.

The incidence of the deaths from diarrhœa in London and neighbourhood also shows that this disease is mainly due to the increase in the temperature of water-supply, and not to atmospheric temperature, as in all those districts supplied from the River Thames the water naturally gets to its highest temperature at an earlier period than it does in those districts supplied from wells, as in the Kent Water Company's district, where the temperature of the water at its source is pretty uniform throughout the year, and in which the water is naturally colder in summer, at starting through the mains, then is the case with the river water. An examination of the mortality tables of London shows that, while the general mortality from diarrhœa in districts supplied by the Kent Water Company and the River Water Companies is practically identical, the disease always first manifests itself in the districts taking water from the Thames. For example, in 1878, diarrhœa may be said to have been epidemic in Lambeth, supplied by river water, in the week ending 29th June, and arrived at its highest pitch in the week ending 27th July, whereas in Greenwich, supplied with the Kent water, this disease did not become epidemic until the week

ending the 17th July, and arrived at its highest pitch in the week ending the 3rd August, showing the incidence of this disease to be later in the Kent Water Company's district, than in the district supplied from the River Thames, the reason being that, as the water of the Kent Company is colder at its source than the Thames water, naturally it requires the ground to be raised to a higher temperature before the water reaches a dangerous point, and therefore the incidence of the disease falls later in the Kent district than in the district supplied from the River Thames. The development of the disease, in these districts, is also conformable to water being the cause, and not general atmospheric increase in temperature, for if the cause were due to atmospheric influences, which are general, the incidence of the disease should have fallen at the same period in each district, but as the incidence is strictly conformable to increase in temperature of the respective water-supplies, and does not conform with atmospheric causes, the inference to be drawn is that summer diarrhœa is governed by the influence of the temperature of our water-supplies, as invariably the disease becomes epidemic when the water, whatever be its source of supply, reaches a temperature of about 62·0°.

Having now shown that water may be affected for good or evil by reason of its temperature, and having also shown in a former paper that the earth has enormous powers of influencing the temperature of water-supplies, the author desires to point out a mode by which the temperature of the earth may be made use of, in order to give water a nearly uniform temperature throughout the year, which, if brought into general operation, the author believes, will remove those dangerous conditions of town water-supplies, arising from an increase of temperature in the summer time, and also, possibly, from the extreme coldness of the water in winter periods, which affect public health.

The great changes of temperature in the earth occur within a few feet of the surface. The greatest range of temperature occurs at the surface, and as we pass downwards from the surface to a depth of from 30 to 35 feet, the temperature becomes nearly uniform throughout the year, and at the point of uniform temperature, the temperature is equal to the average yearly temperature of the place where the observations are made.

From a number of observations made by the author, at depths varying from 6 inches to 50 feet, it is shown that, at a depth of 20 feet, the coldest temperature is experienced in the middle of May, and the warmest temperature, at this depth, at the end of October. The range in temperature observed at this depth is 5° in Croydon. At 25 feet in depth, the coldest period occurs at the beginning of July, and the warmest period in the winter, the range in temperature being a little over 1°. At a depth of 30 feet, the coldest temperature occurs in July. If an apparatus similar to that which has been invented and patented by Professor J. T. Way and the author, is used for tempering the water, and which consists simply of a vertical tube driven or screwed into the ground to a depth of about 25 feet, the water or other liquid to be tempered being admitted at the top and withdrawn at the bottom of the tube, and special arrangements being adopted for the protection of the ascending pipe, the range of temperature in the water required for dietetic purposes need not exceed 3° throughout the year, when drawn from a 3-inch tube, at a rate not exceeding one gallon every half-hour. The range of temperature observed in cistern water at Croydon has been 38·7° ; or on the 22nd July, 1878, it was 71·5° ; and on the 20th January, 1880, it was 32·8° The town water-supply of Croydon (drawn direct from the mains), the temperature of which has been shown to be nearly uniform at its source in the wells, when distributed by a system of constant service, was shown to be 64·8° on the 22nd July, 1878, and 37·2° on the 28th January, 1880, giving a range of 27·6°.

In the tempering tube, when the conditions of the water-supply are at the worst, the underground temperature is favourable for modifying these dangerous conditions. The cold of winter only descends to the greater depth in the heat of summer, and the warmth of summer only descends to the greater depths in the winter time, so that the temperature of the cold water of winter is raised by the previous summer's heat, whilst the warm water of summer is cooled by the previous winter's cold temperature.

Experiments made at the author's house in July, 1880, show that if 10 gallons of water are drawn at any time within half-an-hour, the following results are obtained :—

1st Gallon.—Temperature of water going into tube, 68·4° ; and the temperature of the water coming out was 50·4°

2nd Gallon.—The temperature was reduced from 68·2° to 50·8°

3rd Gallon.—The temperature was reduced from 68·2° to 51·7°

4th Gallon.—The temperature was reduced from 68.0° to 52·4°

5th Gallon.— The temperature was reduced from 68·0° to 53·3°

6th Gallon.—The temperature was reduced from 68·0° to 54·2°

7th Gallon.—The temperature was reduced from 68·0° to 55·0°

8th Gallon.—The temperatnre was reduced from 68·0° to 55·8°

9th Gallon.—The temperature was reduced from 68·0° to 56·4°

10th Gallon.— The temperature was reduced from 67.9° to 57·2°

These experiments have been repeated at various times, and give precisely identical results. In the winter the water is raised in temperature, as for example, on the 3rd February, 1880, water going into the tube had a temperature of 34·8° , and coming out a temperature of 49·2°

The advantage of the use of this apparatus consists in the fact, that it is entirely self-acting, and the whole of the water-supply necessary for dietetic purposes may be filtered, purified, and tempered, without any greater cost than now incurred, after the first cost of apparatus, and without adding anything of a deleterious character to the water, as may be the case when ice is used, which has been shown, especially in America, to be a prolific cause of disease, when collected from impure sources. Moreover, the results secured by the tube are more than equal to those attained by the most bountiful use of ice, and further, it is doubtful if by the use of ice in water already subject to influences that are deleterious to health, the time allowed before the water is consumed is sufficient to destroy its noxious properties. In the case of the patent tube, however, a mass of water is gradually undergoing the process of tempering, in a perfectly natural way, until it arrives at a temperature which is shown by experience to be most healthful.

EXTRACT FROM A PAPER IN LONGMAN'S MAGAZINE,

FOR MARCH, 1883,

BY DR. B. W. RICHARDSON, M.D., F.R.S.,

ENTITLED

"HEALTH IN A HEALTH RESORT."

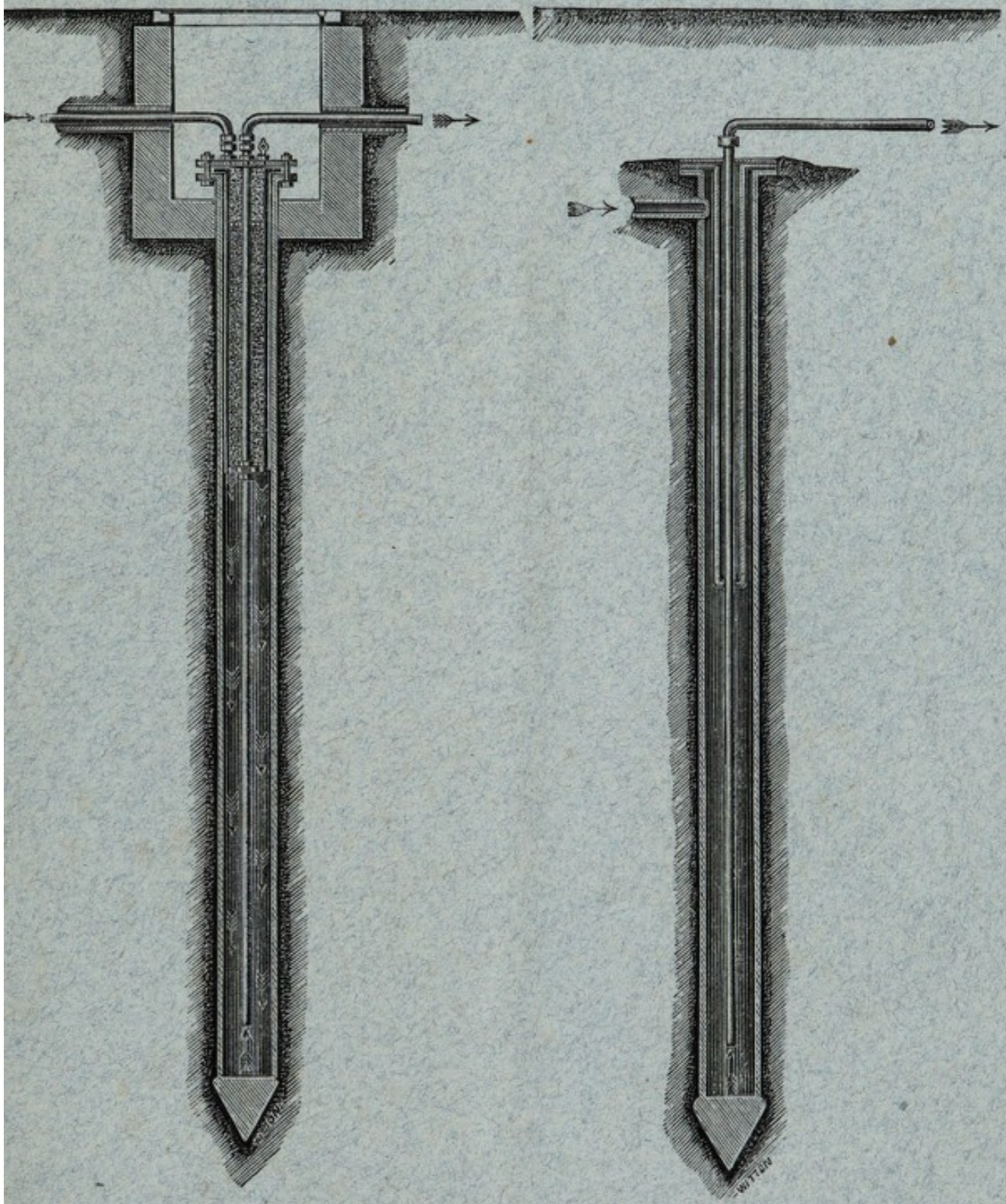
OUGHT a water of a model town to be brought to a given fixed degree of softness? Ought a water of a model town to be kept at an equable temperature?

The answer to the first question ought, I think, to be affirmative. A water to be quite free from injury to health should not have more than 8° to 9° of hardness, and when it exceeds that it should, by the lime-softening process, be brought down to the proper standard. In Canterbury the authorities have carried out this process on an extensive scale, and nothing could be more satisfactory than the result. I have visited the works for softening of water in Canterbury for the purpose of gaining a good practical lesson, and I came away so much surprised and instructed, I would recommend every sanitarian who has not been to make amends to himself by going as soon as he can.

I have no doubt myself that a hard water, taken as drink, is a cause of constipation, dyspepsia, and some other derangements of the body which I will not call actual diseases. I feel, also, that the evidence is very nearly conclusive that hard water, as a drink, does, as it is often supposed to do, produce glandular swellings in the neck—*goître*—in susceptible persons. We all know that a hard water makes bad tea, and is a bad medium for ablution. Of late years we have lost the dread which was once held in respect to the deleterious action of soft water on leaden pipes because we are beginning to use iron instead of leaden conduits; so that on all grounds the soft-water supply becomes urgent for every town that claims to be called a health resort.

The idea of keeping a town supplied at all seasons with water having a uniform temperature is of quite modern development. We are indebted for it to Mr. Baldwin Latham, and, in my opinion, the debt is considerable. Mr. Latham urges that in summer time the water stored in houses, or even in outside reservoirs, becomes heated, and by that means is a ready cause of decomposition of organic matter, and a cause indirectly of the intestinal disturbance which is often present in hot sultry weather. To prevent this accident Mr. Latham has invented an ingenious plan by which he brings the water into every house by a tube which has been driven many feet into the earth—to a point, in short, where there is a persistent low temperature. At all seasons, therefore, the water drawn into the house furnished with this tube is what is called cold, and, what is of more importance, it is of equal temperature; it drinks like fresh spring water. Latham's would probably be too expensive a process to introduce into every house, although the simple and rapid manner in which the tube is driven into the ground is a model of ingenuity. But in all public places in a health resort it should certainly be introduced. It should be in every hostel, at every drinking fountain, in every public lavatory.

LATHAM AND WAY'S
PATENT WATER TEMPERING TUBES.



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