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“The Use and Durability of Wrought-Iron Pipes.”

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THE durability of wrought iron for structural purposes has been the subject of much discussion, and although it is generally admitted that this material is unsuited for use in contact with the soil, there are grounds for advocating its employment in the distribution of ordinary coal-gas. The events to which attention is directed in this Paper occurred in the town of Hay, New South Wales, situated on the Murrumbidgee River at an altitude of 300 feet above sea-level, distant 450 miles from Sydney by rail, and lying in an extensive plain devoted almost entirely to pastoral pursuits. The soil is of a light sandy nature, but unsuited for agricultural requirements owing to the scanty rainfall.

In the year 1885 the gas-works were built, and the usual course was adopted of laying the consumers' services of ordinary black wrought-iron pipe. The conditions of climate appeared to warrant the expectation that precautions such as are usual in the humid climate of the United Kingdom would not require the same consideration in New South Wales; that these conditions differ greatly will be seen from the Table of rainfall and temperature given in the Appendix. It was assumed that the dryness of the climate would constitute a factor in the preservation of all ironwork, and this has proved to be so, but only in the case of iron not in contact with the soil. After the lapse of 11 years, attention was drawn to a steady increase in the amount of gas unaccounted for, and examination led to the discovery that the pipes had completely perished, and exposure to the air had caused them in some instances to crumble to pieces, while in others the granulated appearance of the external surface suggested galvanic action between the metallic base of the soil and the wrought iron. The suggestion that the action of coal-gas was in any measure accountable for the corrosion, was not upheld by any facts elicited during the investigation. The interior of the pipes may, through the action of impurities in the gas,

scale and become filled with rust; but the evidence in this case strongly supported the assumption that the injury was due principally to external causes, and this theory is partially borne out by the fact that wrought-iron water-service pipes, in the town, have a life of only 7 years. The influence of soil in contact with the metal has been held responsible for the structural alteration of its character, but it has not been proved that the deterioration is due to the constituents of the soil, to dampness, or to the alternations of moisture and dryness; and it is probable that, owing to the light character of the soil, the great variations of temperature throughout the seasons exercised some influence. Analysis of the soil disclosed the presence of large quantities of common salt and magnesium chloride, in addition to iron, alumina, silica, lime, and phosphates. Owing to the dryness, heat, and length of the summer season, it is customary to water the streets frequently, and, as they are uniformly level and without any system of drainage, the subsoil is continuously damp. It is conjectured that, as the result of this periodical and frequent street watering, the combination of carbonic acid with the moisture so readily absorbed by the porous earth, formed the basis of chemical action, and the alternate moisture and dryness no doubt greatly facilitated the process of deterioration. To all appearance, the trouble is confined to wrought iron, the cast-iron mains not showing any sign of unusual injury. Experience in other parts of the colony is quite at variance with that at Hay. In Bathurst, where the soil is of a rotten granite nature, services are still in use, and apparently quite sound, after a life of 27 years.

In relaying the Hay services the preservative measures adopted consisted in applying heat to the pipe and then coating it with boiling coal-tar, with a little lime added to neutralise the carbonic acid before application, and in embedding the pipe in a layer of asphalt. Raw tar is not well suited for coating iron. Instances have been known of damage resulting from its use, the injurious action arising from the presence of carbonic acid. Exception has been taken to the inference that lime exerts a protective influence over wrought iron, since from its hygroscopic character it must act as the vehicle for conveying the very element which it should be the aim to exclude. Where clay is obtainable, puddle is recommended for the envelopment of pipes, as a preventive against injury by corrosion.

[APPENDIX.

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RAINFALL AND TEMPERATURE AT HAY, N.S.W. YEARS 1888 TO 1899.

Rainfall (in inches).	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
January	0.25	2.14	0.00	3.00	0.31	0.01	1.96	1.49	0.47	1.40	0.02	0.79
February	0.75	2.43	0.96	0.00	0.07	0.02	0.46	4.85	1.56	0.53	1.89	0.69
March	0.31	0.00	2.55	1.69	0.39	0.62	3.58	0.62	0.85	0.09	0.07	0.55
April	0.53	4.50	1.31	3.14	0.63	1.28	1.79	1.52	3.49	0.01	0.34	0.50
May	2.25	4.06	1.20	0.71	2.10	2.54	0.68	0.21	1.54	0.47	0.64	0.19
June	0.47	2.04	3.42	1.51	1.25	1.25	3.09	2.43	1.14	3.25	2.50	2.17
July	0.31	0.18	2.32	1.86	1.60	1.32	1.32	1.15	0.57	1.67	0.64	1.04
August	0.50	4.17	1.00	1.88	1.84	1.48	1.85	0.94	1.30	1.00	2.04	1.09
September	0.84	1.40	0.59	0.99	2.16	1.68	0.78	0.45	0.72	1.46	0.41	0.30
October	0.36	1.45	1.88	1.22	3.49	1.33	2.29	0.45	0.33	0.86	0.71	..
November	0.03	3.26	1.31	0.70	1.69	1.79	0.22	0.00	0.93	0.22	0.49	..
December	0.53	0.21	0.82	0.46	0.02	0.49	3.84	0.39	0.25	0.45	1.19	..
Total	7.13	25.81	17.36	17.16	15.55	13.81	21.86	14.50	13.15	11.41	10.94	..

Mean temperature in shade

Mean maximum " " 63.6°.

Mean minimum " " 95.5°, hottest month.

Mean diurnal range " " 35.9°, coldest month.

28.6°.