

using a cylindrical roller, two and a half to three feet in diameter and five or six feet long, weighing one and a half to two tons. A better design is to have two such cylinders arranged in a frame, one behind the other, each being composed of two short cylinders, two and a half to three feet in length, placed abreast on the same axis. Gravel roads, carefully constructed in the manner herein described, will possess all the essential requisites of a good road.

### Macadam Roads.

Macadam roads are constructed with successive layers of broken stone applied in a manner similar to that described for gravel roads. If the best quality of stone cannot be procured for the whole of the road covering, care should be taken to select the hardest and toughest stone for the upper, or preferably, for the two upper layers, having an aggregate thickness of about six inches. The stone should be broken into fragments as near cubical in form as possible, the largest of which should not exceed two and one-half inches in largest diagonal dimensions. For inspecting the broken stone an iron ring, two and a half inches in diameter, may be used with advantage. If the material to be used be very tough or hard, like most of the basaltic and trap rocks and the scientific granites, or if the traffic upon the road be light and its amount not large, the stone may be broken smaller without danger of their crushing too easily or wearing too rapidly; the smaller the fragments, the less will be the volume of voids in the road covering liable to become hard and smooth when open to traffic. No amount of rolling is sufficient to produce a thorough binding effect upon the stones, or to cause such a mechanical union and adjustment of their sides and angles together as to enable them mutually to assist each other in resisting displacement by the action of waggons and horses' feet. Broken stone, of ordinary size and of the very best quality for wear and durability, with the greatest care and attention to all the necessary conditions of rolling and compression, will not consolidate in the effectual manner required for the surface of the road, while entirely isolated from and independent of other substances. In order to decide upon the fitness of any particular kind of stone for road covering, and especially where there are several kinds equally available, or so nearly so that the question of selection should be governed by the quality alone, an examination and tests of the varieties should be made, in order to determine their relative toughness, hardness and power to resist abrasion. In some cases the difference of quality is so pronounced and so well known that the opinion of intelligent stonecutters, who have been accustomed to work the various kinds of stone into various forms, with different tools, will be sufficient to indicate their order, though not their degrees of merit, for the purpose in view. When, however, the formation thus obtained is deemed inadequate or inconclusive, the merits of the examination should be, 1st, the toughness of the stone; 2nd, its power to resist abrasion; 3rd, the compressive strength of the stone.

### Telford Roads.

Telford roads are named after Thomas Telford, by whom they were first constructed. They are made with layers of broken stone, resting upon a sub-pavement of stone blocks. A level bed is first prepared for the road material, a bottom course or layer of stone is to be set by hand in the form of a close, firm pavement. The stones are set in the middle of the road and are about six inches in depth; the are set on their broadest edges and lengthwise across the road; the breadth of the upper edges are about four inches. All the irregularities of the upper part are broken off by hand hammers, so that when the whole pavement is finished there shall be a convexity of about

four inches in the breadth of fifteen, measuring from the centre; the middle eighteen feet of pavement is coated with hard stones to a depth of about six inches. The first four inches of this is to be put on first and worked down with horses and carriages; the ruts are raked in, and the surface becomes firm and consolidated, then the remaining two inches are put on the remainder of the roadway to be coated with strong gravel. Derived from this pavement there are various ways of paving, such as the Telford sub-pavement, Telford sub-pavement with gravel and broken stone on top, concrete foundation, surmounted with gravel or broken stone.

### Charcoal Roads.

The novel expedient of using charcoal for road covering is not likely to be resorted to except in newly-settled, heavily-wooded districts, where standing timber has no market value and must be gotten rid of before the land can be devoted to agricultural pursuits. Take timber from eight inches to sixteen inches in diameter, and twenty to twenty-four feet long, and pile it up lengthwise in the centre of the road, about five feet high, being about nine feet wide at the bottom and two feet at the top, and then cover it with straw and earth in the like manner to coal pits, the earth required to cover the pile being taken from either side, leaves two good-sized ditches, and the timber, though not split, is easily charred, and when charred the earth is removed to the sides of the ditches, the coal raked down to a width of fifteen feet, leaving it two feet thick at the centre and one foot at the sides and the road is completed. This material is found to pack well, not form into ruts or get soft or spongy in wet weather.

### Water Supply.

Water is one of the most indispensable elements of life, health and happiness, affecting everything connected with eating, drinking, and cleanliness, as well as affording protection from stench, disease and fire, and as provided by a suitable public works constitute one of the most economical, convenient and labor-saving means of the age; hence its indispensability, in both quantity and quality, will not be questioned.

In the comparison of the various sources of supply, the questions of quality, quantity and cost of development, are the principal ones to be considered. The weight to be given to each depends on the local and conditional circumstances of the community for which the supply is under consideration. Purity of water prevents innumerable ills and pestilential diseases of man and beast. Its importance and value in this respect cannot be over-estimated. It would be indispensable even were it possible to obtain perfect chemical purity in water. Distilled water, which is the nearest approach to perfectly pure water, is quite flat and insipid to the taste, due for the most part to the absence of absorbed gases. Most people prefer a water containing a reasonable amount of matter in solution, and a large amount is sometimes found in water which is suitable for drinking purposes and even highly prized, as in the case of numerous mineral springs.

For the manufacturing purposes, however, the absence of mineral salt in any great amount is desirable, especially the absence of the carbonates and sulphates of lime and magnesia. These substances give rise to much trouble by the formation of incrustations in boilers and in domestic use by the formation of a "curd" with soap. Mankind has learned by dear experience the close connection that exists between factory and household wastes and certain forms of disease. Whether filth may produce these diseases or whether it acts merely as a nidus for their development is still in dispute. The

weight of evidence shows, and the best authorities agree, that the water supply may become the cause of disease both by direct action through its impurities and as a means of transmission from some other source.

Under a suitable head, and in ample quantity, as provided for public use, it often, in a single instance, prevents an amount of loss by fire alone equal to the entire cost of its supply, to say nothing of the countless other comforts and blessings that an abundant quantity of water affords.

No expense by city, village, town, public institution, mill or factory owners, or families generally, can be more satisfactorily or economically incurred than for the provision of an abundant and ready quantity of pure and wholesome water, for health is an inestimable boon, and "cleanliness is next to godliness."

Besides these considerations, the introduction of public waterworks invariably enhances the value of real estate and other property, by rendering residence more desirable and thereby attracting occupants, as also affording better facilities and advantages for manufactories and various classes of business. The necessity and desirability of public water supply is being sadly overlooked, in many places where it should receive immediate attention and introduction, as one of the greatest considerations relating to health, comfort, luxury, convenience, safety and profit. Therefore, the quantity, quality and means of supply of this much-needed element, becomes an interesting question to all, and should receive the prompt and careful consideration of those who are delegated to attend to the means of its provision. It is the official and moral duty of physicians, health officers and authorities of cities, villages and towns to instruct the people and agitate the subject relating to the necessity of providing public waterworks as an additional means of health, security and prosperity.

### Notes.

#### The Galt and Dundas Road to be Bought.

GALT, Nov. 18.—A meeting was held in the council room at the town hall, consisting of representatives from the various townships and municipalities interested in the purchase of the Waterloo and Dundas macadamised road. Several of the representatives had interviewed Mr. Harcourt, of the Provincial Government, a week ago, who intimated to them that the road could probably be bought for the sum of \$7,500 by the townships and municipalities through which the road runs, on the condition that it be made free. After much discussion over the proportion of the cost of purchase that each should bear, the matter was narrowed down to a difference that Galt and Dumfries should decide. The delegates of these two places retired and a settlement was come to between them. A resolution was then put to the meeting that the proportion which each municipality or township should bear towards the purchase of the road should be as follows: Flamboro, \$2,100; Beverly, \$2,100; Galt, \$1,350; Dundas, \$1,150; Dumfries, \$800; total, \$7,500. Each municipality and township will keep in repair and improve the road lying within its limits.

The Dundas *Banner* says the County Council should follow up the action taken in regard to the Dundas and Waterloo road and make the rest of the roads in the county free. This would be a move in the right direction. Both Dundas and Hamilton would be benefitted if the tolls on the roads leading into those places were abolished. Many years ago the County of Wellington was among the first to abolish the tolls on her system of gravel roads, which were then, and are now, the best in the Province, and the county greatly benefitted