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a safe tter in ere are ore an robable placed. Indeed, the environment of each well must be carefully studied; general statements on this subject are apt to be wide of the truth.

If the well is dangerously near a source of pollution, or there is the slightest doubt about the water, the only satisfactory and conclusive way to ascertain the true condition of affairs is to have an analysis made of the water. Sanitary (chemical) analysis of waters from farm home steads are made in the laboratories of the Experimental Farm, Ottawa, but it is required that the applicant first obtain a copy of the directions to be followed in the collection and shipment of the This work of water analysis has been carried on since the establishment of the Experimental Farms, and undoubtedly has been productive of much good. Reference to the reports of the Chemical Division will show that a very large number of the waters so forwarded have been found polluted, and many of them exceedingly dangerous. These reports also point out how such waters may disseminate disease in the farmer's family, prove injurious to his stock, and render his dairy products unwholesome and unsafe.

With respect to a recent inquiry regarding the value of the hypochlorite of lime treatment of the water in the water in the well, we think there are practical difficulties which make it a very unsafe and unsatisfactory plan to adopt. If the water were drawn and placed in a vat or tank, which would act as a reservoir, it might be so treated effectively; but the cheapest, the easiest and the most effective safeguard is boiling. This simple method is far superior for the farmer and village householder to any treatment with chemicals. We have advocated it for twenty-five years, and today it stands unequalled as a simple treatment for the destruction of typhoid and allied germs; it must have prevented much disease, and, no doubt, saved many lives. However, my last word is, abandon the polluted well, obtain the very best water that can be procured, and be prepared to spend a good deal of money, if necessary, in the work; be morally certain that the water is unpolluted, and then protect the source. ing is more insidious in its action than impure water; few things on the farm are so valuable, as important to the health of the farmer, his family and his stock, as an abundance of pure water. It is something worth paying for.

Surface Treatment for Dust-laying and Road Preservation.

By W. A. McLean, Provincial Engineer of Highways for Ontario.

Dust prevention has long had a recognized place in urban communities of Ontario, the watering-cart in dry summer weather being the remedy commonly applied with moderate success. At best, however, there are intervals when temperature and breeze are too nimble for the water supply, and the man on the watering-cart is deluged with complaints proportionate to the dust that descends on the pedestrians and adjacent lawns. When an adequate service is available, and the driver uses intelligent discretion as to the amount of water applied, the sprinkling wagon is an agreeable means of subduing dust-but very rarely is the right combination of service and intelligence applied to the work, with the result that as a means of subduing dust, water-sprinkling has not been effective.

The oiling of roads in California, Pennsylvania rumor and experiment for some years, but it was and other petroleum re not until 1909 that a serious test was made in Ontario, when a residuum of petroleum, with a paraffin base, was used on the streets of Toronto. Vox populi was at once heard in complaint and objection. "The odor of the oil was offensive, and the oiled mud ruinous to paint, clothing and carpets." But the disagreeable odor But the disagreeable odor passed away in a few days. A small quantity of oiled mud or dust was found no more injurious to clothing and carpets than was a large amount of dry dust. The dust nuisance was remedied to an extent unknown before on macadam and earth roads. Citizens no longer inhaled clouds of dust. Continued experience in 1910 in Toronto, and in other parts of Ontario, has confirmed the use of oil as a success, a measure of comfort and sanitation, in which the benefits outweigh the objectionable features.

A new factor, the motor vehicle, has of recent years entered the domain of traffic, and has placed new demands upon the public highway. Ten years ago, traffic on the roads of England had only five per cent. of motor vehicles, while last year 70 per cent. was motor traffic. number of motor vehicles in Ontario is increasing rapidly, farmers are now among the users, and it is evident that the use of the public highways by this new mode of travel and transportation has tremendous possibilities. Already the motor traffic on some of the roads of the Province has brought the dust problem into association with country roads, with attendant discomfort to users of the road, and injury to crops, fruit, lawns and

The scattering of dust by rapid and frequent motor traffic is a serious injury to the road itself, in that the dust is a necessary bonding ma-

terial for the stone composing the road; and when this is removed, the road "unravels," roughens and deteriorates. Present motor traffic in some cases is now demanding dust-laying treatment; and future traffic will, in the writer's opinion, require it upon a considerable mileage of heavily-travelled roads in the Province, as a matter of preserving them from destruction.

Dust-laying treatment may be little more than a palliative by which the dust is prevented from rising, and remains as a cushion coat over the Or treatment may go further, and may provide for a stronger and tougher road surface that will resist wear by bonding and protecting the stone. As palliative treatments may be considered the use of the old sprinkling wagon, of calcium chloride, oil emulsions, and petroleum oils with paraffin base. With the protective treatments may be included the use of asphalt and asphaltic oils, now being so largely tested in the United States, and the several tar treatments adopted as standard practice in England and Scotland.

Calcium chloride in solution is merely an improved method of water sprinkling. A salt with an affinity for moisture, the principal effect of calcium chloride is to retain the moisture of the atmosphere, thus lessening the necessity of so frequent watering. The effect, however, is temporary, and its use is limited.

OILING ROADS

To oil roads successfully, requires a thorough understanding of the oil used, its constituents, and method of preparation. A petroleum oil is generally employed, but some of these, such as the



A Roadman.

California oils, have an asphaltic base, while those of Ontario and Pennsylvania have a paraffin base. Asphalt is a binder, while paraffin is not, and in an asphaltic oil will destroy the binding properties of the latter. While heavy asphaltic oil, free from paraffin, may be used within the body of the road, or sprinkled over the surface, paraffin oils can be used only by the latter method.

Paraffin oil, such as that used in Toronto, may be sprinkled from an ordinary watering-cart, and on country roads during the past season, crude, homemade distributers, attached to common water-wagons, were made from perforated gas pipe with success. The oil should be applied to the road in warm, dry weather. applications early in the season, followed by two or three later, according to the weather, have been found sufficient to keep down the dust, using for the season, on a country road, about 3,500 gallons. About 1,500 gallons per mile should make the first two applications. according to local conditions, but has been about 4 cents a gallon, and one cent for applying.

Asphaltic oils may contain a varying percentage of asphalt, up to about 80 per cent. Great care is needed in putting it on the road, to avoid splashing and inconvenience to traffic. Oils with a high percentage of asphalt have to be heated to apply to the road. Special sprinklers are desirable, with the distributers close to the road

surface to avoid splashing. One-half of the road only should be oiled at a time, to prevent incon-Immediately, or venience to users of the road. within a few hours after applying, the surface should be sprinkled lightly with clean, coarse sand or stone chips. Before applying, the road should be swept clean and sprinkled to slightly moisten the surface, but the weather should be dry. If rain approaches, be sure to get the oil covered and partly absorbed by the screenings, otherwise the oil will be splashed out to the roadsides. One-quarter of a gallon of oil to the square yard in each of two applications will last one season, and in some cases more.

Oil emulsions in which alkali or acid chemicals are used to "cut" the oil are more easily applied, but their effect is temporary.

The cost of two applications of asphaltic oil in two applications each of one-quarter gallon per square yard, is given by the chairman of the Massachusetts State Highway Commission, as

('ents.
Cleaning and sweeping	
Heating oil	.38
Distributing oil	.20
Spreading sand Watering Rolling	.12
Supervision	
Total per square yard	7.00

ASPHALTIC BINDERS.

In American practice, one of the most recent departures is the use of heavy asphaltic oil as a road-binder, applied by the penetration process. That is, over the main road foundation is spread a surface coat of 11 or 2-inch stone, about two or three inches in thickness. After being once rolled, the heated asphalt oil, containing about 80 per cent. asphalt, is poured into the interstices Over this is spread a light coat of stone screenings, and the steam roller completes of the stone. consolidation. A paint course of asphaltic oil is then applied, and this is followed by a final dust coat of stone chips well rolled in. By the same coat of stone chips well rolled in. method, lake asphalt, fluxed with oil in the usual manner, is employed in the road.

Lake asphalt fluxed with oil may be heated and mixed with stone, but the mixing process is found too expensive for country roads. The penetration method itself is only suitable for roads of heavy traffic, in which the cost of repair would otherwise be large, because of constant motor or heavy team traffic.

The cost of bituminous pavements in New York State last year was approximately 20 cents per square yard for each inch in depth of the per square yard for each little in the penetrated matrix. The stone was usually penepenetrated matrix. The stone was usually penepenetrated matrix. trated to a depth of two or three inches. class of treatment was used principally on State road metalled to a width of 18 feet.

TARRED ROADS.

The tarring of roads for preservation and dust prevention has become the standard practice in England, and is applied in several ways, which may be classified as (1) tar painting or spraying, (2) tar grouting, or penetration; (3) tar macadam; (4) tar matrix.

The tar in England is coal-gas tar, and is of a more uniform quality than that produced in this Tar varies greatly, according to the coal used and process of gas manufacture in which the tar is obtained. This lack of uniformity has, in part, been responsible for much of the inferior tar-macadam roads in Ontario, and for the feeling among engineers that its use is too uncertain a

In general, the tar should be refined by heatquantity. ing, to drive off volatile oils, and other ingredients are added. After refining tar for spraying may have added to it a quantity of linseed oil, to cause it to flow more smoothly. The tar painting or spraying method is a surface treatment, and may be by hand or by machine, the tar being spread over the surface of a macadam road in a thin layer, and a light coating of stone

chips or fine gravel rolled in. The tar-grouting process is similar to the penetration method of the United States. The tar is heated, fluxed with oil, and is then poured into the interstices of a surface coat of broken When the tarring is finished, the surface is sprinkled with a coat of stone screenings or clean gravel, and is thoroughly rolled; then is completed with a paint course, topped with screenings, and rolled. The cost of a grouted surface of tarred stone in English work is about

12 cents a square yard. In tar-macadam, the stone and tar are handmixed, both stone and tar being heated. mixture used for this purpose usually contains tar, pitch, and creosote oil. The proportions are about 50 pounds of pitch, 12 gallons of tar, 2 gallons of creosote oil, and one ton of broken stone. The pitch is broken into fragments and