

Ruts.

With gravel roads there is a pronounced tendency to rut, and when ruts begin to appear on the surface, great care should be used in selecting new materials with which they should be immediately filled. Every hole or rut in the roadway, if not tamped full of some good material, like that of which the road is constructed, will become filled with water and will be made deeper and wider by each passing vehicle. A hole which could have been filled with a shovelful of material will soon need a cartful. The rut or hole to be repaired should be cleared of dust, mud, or water, and just sufficient good, fresh gravel placed in it to be even with the surrounding surface after having been thoroughly consolidated with a pounder. Sod should not be placed on the surface, neither should the surface be ruined by throwing upon it the worn out material from the gutters alongside. Ruts and holes in earth roads should not be filled with stone nor gravel unless a considerable section is to be so treated; for if such material is dumped into the holes or ruts, it does not wear uniformly with the rest of the road, but produces lumps and ridges and in many cases results in making two holes for every one repaired.

Reversible road machines are often used in drawing the material out of ditches to the centre of the roadway, which is left there to be washed again into the ditches by the first heavy rain. A far more satisfactory method, when the roadway is sufficiently high, and where a heavy roller cannot be had, is to trim the shoulders and ridges off and smooth the surface with the machine. This work should begin in the centre of the road, and the loose dirt should be gradually pushed to the ditches and finally shoved off the roadway or deposited where it will not be washed back into the ditches by rain. Where this method is followed, a smooth, firm surface is immediately secured, and such a surface will resist the action of rain, frost and narrow tires much longer than one composed of loose and worn-out material thrown up from the ditches.

In making extensive repairs, plows or scoops should never be used, for such implements break up the compact surface which age and traffic have made tolerable. Earth roads can be rapidly repaired by a judicious use of road machines and road rollers. The road machine places the material where it is most needed and the roller compacts and keeps it there. These two labor saving machines are just as effectual and necessary in modern road work as the mower, self-binder, and thrasher are in modern farm work. Road machines and rollers are the modern inventions necessary to satisfactory and economical road construction and repair. Two good men with two teams can build or repair more road in one day with a roller and road machine than many times

that number can with picks, shovels, scoops and plows, and do it more uniformly and thoroughly.

One of the best ways to prevent the formation of ruts and to keep roads in repair is by the use of wide tires on all wagons carrying heavy burdens. In most foreign countries they not only use from 4 to 6 inch tires on market wagons but on many of the four-wheel freight wagons, in addition to wide tires, the rear axles are made 14 inches longer than the front ones, so that the hind wheels will not track and form ruts. Water and narrow tires aid one another in destroying the roads, while on the other hand wide tires are roadmakers. They roll and harden the surface, and every loaded wagon becomes, in effect, a road roller. The difference between the action of a narrow tire and a wide one is about the same as the difference between a crowbar and a tamper; the one tears up and the other packs down. By using wide tires on heavy wagons the cost of keeping roads in repair would be greatly reduced. The introduction in recent years of wide, metal tires which can be placed on the wheels of any narrow-tired vehicle at a nominal cost, has removed a very serious objection to the proposed substitution of broad tires for the narrow ones now in use. The formation of deep ruts has been prevented on some of the toll roads of Pennsylvania by lengthening the doubletrees on wagons and by hitching the horses so that they will walk directly in front of the wheels, a device worthy of consideration.

Testing Portland Cement.

The testing of cement, although a simple process, requires much experience, skilful manipulation, and careful observation to secure sufficiently accurate results. Numerous tests have been suggested, but many of them are of uncertain value, others are exceedingly difficult of application, or require expensive instruments.

The accompanying specifications cover the principle points which are necessary to a safe cement, and which can be readily enforced.

Test No. 3, indicates the degree of fineness to which the cement is ground, upon which its strength greatly depends. While fineness is not a certain proof of the value of the cement, yet all cements are improved by fine grinding. If otherwise good, the finer the cement, the greater the amount of sand it will take in making a good mortar.

Test No. 4, shows the time a cement will take to set, and while not indicating the ultimate strength of the cement, it is a guide as to the work to which the cement is adapted. For submarine work, a quick setting cement is often a necessity, but for work in the open air, a cement should not require too rapid manipulation in mixing and putting in place before it begins to set, especially for sidewalk, curb and similar construction.

Test No. 5 (a), is most valuable and necessary, as it serves to detect one of the most dangerous of defects, an excess of free lime. Some cements stand well for short periods, but owing to the presence of free lime disintegrate after a few months. If at the end of three days in water, the thin edges of the pats show no signs of cracking, curling, and disintegrating, technically known as "blowing," the cement may be considered safe, in this regard. Fine air cracks on the upper surface of the pats, which cross and recross one another, are not due to blowing, but are caused by changes in temperature.

The cracks caused by blowing are usually accompanied by a certain amount of disintegration, are wedge shaped, running from the centre of the pat. The boiling test, No. 5 (b), is an accelerated condition to show in a few hours what would otherwise take a much longer period. It is frequently regarded as too severe for all cases, but most sound cements can pass it, and where blowing is developed it should call for a careful consideration rather than its rejection.

Test No. 6 is also indicative of the soundness of the cement, and any change in either expansion or contraction should cause the rejection of the cement. The bottle may be watched for signs of blowing as in No. 5.

In test No. 7, in which pats of neat cement are allowed to set and remain in air, the color should continue uniform throughout, yellow blotches indicating an excess of clay, or that the cement is not sufficiently burned. Under the latter conditions it is probably quick setting and deficient in strength.

A deficiency in tensile strength shown by test No. 9 indicates the presence of too much magnesia, over 3% making a cement unreliable. This test is important, and is the only one demanding an instrument involving any special expense. Moulds are required in which to form the briquettes with exactness, and a means of applying and indicating a tensile strain is required, various kinds being in use for this purpose. This test requires considerable time to perform it perfectly, more than can be ordinarily taken. Some cements develop considerable strength during a short interval, but fail to maintain it for a longer period. It is generally conceded, however, that for a brand of good reputation, the one day test will show whether or not the sample is of its average quality, the seven-day test being, of course, preferable. It is sometimes required that manufacturers shall furnish a sworn statement as to the results of this test, with each lot of cement delivered.

SPECIFICATION FOR PORTLAND CEMENT.

1.—Quality and Packing.—All cement must be of a well and favorably known brand of Canadian Portland cement and shall be delivered in barrels or equally weather-proof packages, each labelled with the name of the brand and the manufacturer. Any barrels or packages broken or