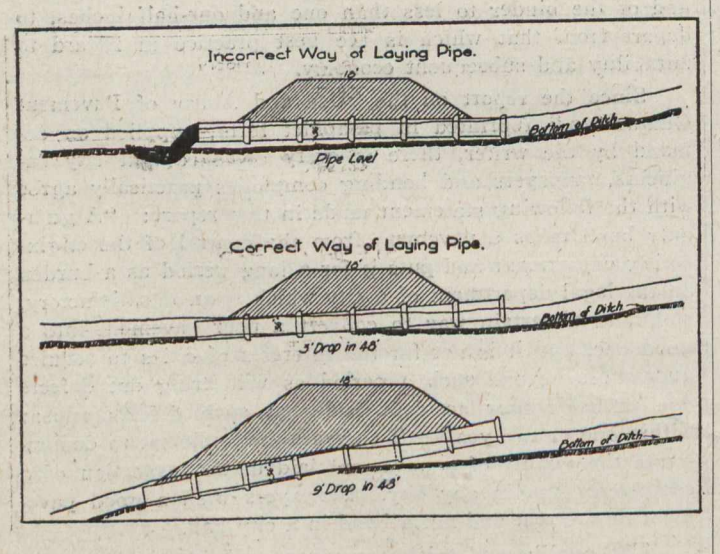
thickness and good quality under municipal engineering inspection, whether guaranteed or not. Water and sewer pipes as well as other municipal construction and buildings are undertaken and finished and accepted, without a time guaranty. Better, more durable and more economic construction is attained and the proper municipal engineers and local officials can be held responsible. A past monopoly of asphalt supply and a desire to introduce asphalt pavements when engineering knowledge of them was not as common to all engineers or easily obtainable as at present, was the cause of the introduction of pavement guarantees. These are now no longer needed. Engineering knowledge of asphalt and other pavements is almost general and experts are available. There are at least 16 different independent and competing sources of supply of good American and foreign refined asphalts or asphalt cements.

In order to fully determine the facts referred to and the opinion that an asphalt pavement wearing surface 2 inches thick laid upon a binder of 1½ inches thickness, guaranteed for five or less years, is to be preferred to an asphalt wearing surface of less thickness guaranteed for even ten years, I sent a circular letter, with suitable questions, to the city engineers of many cities. The condensed opinions of the city engineers from the following cities are examples of the answers received from practically all, and are in accord with the conclusions reached.

LAYING OF CULVERT PIPE.*

By C. H. Bremner.

A common way of laying culverts is to put the culvert in the bank with the upper end about level with the bed of the stream and the lower end nearly to the surface of the ground. Sometimes this gives a fall, but not to a sufficient amount. The culvert should ordinarily be laid in the bank and not in the bed of the stream, but the upper end of the pipe should be at high above the bed of the stream as it is



safe to raise it, while the lower end should be below the bed of the stream, say, 6 in. to 2 ft., depending upon the diameter of the pipe and surrounding circumstances, thus getting as great a fall in the pipe as is possible in each location. The accompanying sketch figures show the right and wrong ways of laying the pipe. In some tests made during the past few years we have had a chance to note the different effect of the two methods. With pipe laid level or nearly so, there is a waterfall effect at the lower end which has a tendency in times of flood to scour out a large hole at the base of the bank, and there have been cases where our banks have been injured and also where we have had to pay for damages to adjacent farm land, which would have been avoided if the pipes had been properly laid. If laid with a steeper slope than the bed of the stream, pipes and culverts will not clog up so readily, but will better keep themselves scoured clean from debris and sand, as there will be a greater velocity in the flow through the pipe, and not the tendency to deposit material which we so often see filling up our openings.

We also can use smaller openings if pipes and culverts are given the proper fall, for they will carry away the water much more rapidly.

Table Showing Comparative Discharge, 36-inch Pipe, 48 Feet Long. Cubic Feet per Minute.

	Laid Level.	6″ Fall.	3′ Fall.	6′ Fall.	9′ Fall.
Pipe running full	2,910	3,518	6,151	9,251	10,990
Head 1 ft. over top of pipe	4,276	4,988	7,957	9,663	11,340
Head 3 ft. over pipe	6,151	6,588	9,251	10,999	12,390

The foregoing table of relative discharges under varying conditions shows that a 3-ft. pipe, 48 ft. long, having a fall of 6 ft. will carry 3.1 times as much water as it would if laid level when the pipe is running full. When there is a head of 3 ft. above the top of the pipe it will carry 1.8 times as much as when laid level, or 3.7 times as much as it will when laid level and only running full. This gain in carrying capacity is applicable to boxes and culverts as well as to pipes, and it is worth while to make a study of each case, in order to get as much fall as possible, under the track, in order that the smallest opening can be used, which will handle the water without danger or damage.

*In Bulletin No. 108 of the American Railway Engineering and Maintenance of Way Association.

NEW INVENTIONS.

The following Canadian patents have been recently secured through the agency of Messrs. Marion & Marion, Patent Attorneys, Montreal, Canada, and Washington, D.C.

Any information on the subject will be supplied free of charge by applying to the above named firm.

125164—Rudolf Ruth, Charlottenburg, Germany, Photographic sensitive plates or films.

125229—Auguste Denereaz, Montreux, Switzerland, Sockets and plugs for Electric Lamps.

125238—John W. Burleigh, Taunton, England, Dynamo Electric Machine.

125249—R. A. McDonald & W. T. Cann, North Sydney, C.B., Orange Peeler.

125251—H. Diamanti & C. Lambert, Paris, France, Apparatus for recovering vapors issued from volatile liquids.

125271—Michael Bohn, Nagykikinda, Hungary, Machine for Cleaning and Sorting Clay.

125304—Karl A. F. Hiorth, Christiania, Norway, Method of Reducing Ores.

125315—Etienne W. Kuhn, London, Eng., Manufacture of Grape Beer.