concentrated load and cannot affect the truss of any but short spans.

(5) Vibration, jarring, jolting, etc., apart from that covered by item 2, need not be considered in highway bridges.

(6) Rhythmic motion set up by the uniform live load on long spans is a possible contingency. In spans which are relatively long for their width there is likely to be a swaying effect in a high wind. Stresses caused by these conditions are probably the only kind of impact stresses that need to be considered in the trusses of highway bridges.

(7) Much uncertainty exists as to actual stresses in highway bridges as well as in railway bridges, but it will be generally admitted that the uncertainties in the former are within much narrower limits than in the latter.

In consideration of all the above facts, it seems to the writer to be quite evident that the question of impact in highway bridges should be considered by itself and that the present methods and formula (at least those commonly used in Ontario) are wrong in principle. How they work out in practice will be discussed in the second part of this paper to be published in a future issue.

A NEW EXPANSION JOINT.

The Barrett Company is now putting on the market a new expansion joint for use in connection with concrete or brick or block pavements. This joint is mastic in character, comes in ribbon form and a variety of widths and thicknesses. The requisite cohesiveness to stand handling and storage in the ribbon form without affecting the elasticity that is necessary for expansion requirements, is given to the material by a new process known as the "fibre weld." The material is water-proof, weather-proof, and is not injured by street acids or automobile oils. Furthermore, it does not become brittle with age or cold weather, and on the other hand, does not soften or run when the weather is hot. Its chief advantage over the usual poured bituminous joint is the elimination of pouring or heating apparatus, which means a great reduction in labor, as it takes but very little time to unroll a joint, cut it and put it in position.

"CANADIAN-MADE ASPHALT."

The refinery of the Imperial Oil Co., Limited, now being built in Montreal, will be, after its construction, the only asphalt refinery in the Dominion of Canada. In the past, practically all the asphalt was of foreign manufacture. The new refinery, which will be one of the most modern and best equipped ever constructed, is for the refining of crude asphaltic oils of the highest grade exclusively, producing thereby the best material possible for the making of asphaltic roads. The equipments of the plant consist of 14 large crude oil stills, many special reductors, and pressure distillators and agitators, and a special factory for the manufacture of metal containers in which, with the aid of tank cars, the material will be shipped. The plant will have a capacity for crude and manufactured products of over 600,000 barrels.

The refinery is located at Montreal East, on a piece of ground containing more than 55 acres, fronting the St. Lawrence River. The property runs over one mile north, crossing Notre Dame Street to above the Canadian Northern Railway Co.'s tracks. The company has on the river front its own wharf, the depth of water being sufficient to permit ocean-going tank vessels, transporting crude oil, to dock at the wharf. The shipping facilities by waterway, either in bulk or in packages, are of a great advantage.

As to the shipping by rail, the Imperial Company has the Canadian Northern Railway and the Montreal Tramways Co. at its disposal, and later will have the Harbor Commissioners' Railway.

This modern installation represents an expense of more than $1,250,000, and when in full operation should employ at least 3,000 men.

TYPES AND COSTS OF SLACK CABLE EXCAVATOR PLANTS.

A FEW years ago the slack cable method of excavation was not well known, and was used only in a few isolated places. Lately, there have appeared on the market, however, a number of excavators employing this principle, and the idea is becoming more popular. This type of excavator, which has been described by A. A. Smock in The Contractor, consists of four essential parts: (1) the bucket; (2) the cable upon which the bucket is hung; (3) the mast, to the top of which the slack cable leads; (4) the engine that controls the operation of the outfit. There are numerous buckets for this use, each designed under some special patent and possessing features that distinguish it from others.

The excavators may be used for soil stripping, handling of coal, ore, rock, or other loose material, and especially for gravel excavation. The increased amount of concrete work in the last few years, together with the popularity of the gravel road or "pike," has caused a great demand for sand and gravel. This was formerly supplied in two ways; first, and most primitive, by driving a wagon to the nearest open pit and loading it by hand; second, by railroad shipments from source of supply to the nearest sidetrack, where it could be unloaded and hauled to the work. The latter method was and still is expensive on account of freight rates, and the former method is becoming less common because these neighborhood pits are gradually being excavated down to the ever-present water, from below which it cannot be removed by hand.

Naturally, the upper layers of gravel above the water are more or less dirty, while that below the water is cleaner when removed. The slack cable excavator can easily remove this gravel from almost any depth and therein lies one of its chief advantages.

The operation of the outfit is very simple, and is under the control of one man. The bucket is brought in by a "drag" cable on the front drum of the hoist, and the track cable is made loose or tight, as desired, by a "tension" cable, which passes over a pair of double blocks, increasing the pulling power of the engine about five times, which is sufficient to tighten the track cable until the bucket is raised clear off the ground. The bucket is drawn in to the dumping point, at which there is generally some device attached to the track cable, causing the bucket to discharge its load, after which it is released, rolling down the tight cable by gravity. The cable is then loosened, allowing the bucket to rest on the ground in its natural digging position ready to repeat the operation.

The power must come from some kind of a double drum hoist, either steam or electric. The most popular size is the one-yard bucket, which is generally operated by an ordinary contractor's double-cylinder, double-drum hoist, sixe 8 x 10, although smaller engines will suffice in easy digging. If electric power is used, the best hoist is a direct-connected one with a system of gears enabling the bucket to be drawn in slowly with great power while loading, and then to be drawn up to the dumping point more rapidly with less lower. In this case, a 50-horse-power, variable-speed motor is sufficient. In occasional plants where electricity is low in cost, the bucket is sometimes operated by means of a hoist which is belt-connected to a 60 to 70-horse-power motor, the larger size being required on account of the loss due to belt slippage, and also on account of the motor running at a constant speed.

The average time required to make a complete trip with the bucket is found to vary a great deal, on account