

attach to the curb cock outside, which is done by lowering the ordinary turn-off key with connection at the top end of it.

To thaw larger pipes a 25-kw. transformer is hauled out on another sleigh; this has not been necessary this winter. As high as 200 amperes have been taken from the 15-kw. transformer when necessary, care having been exercised to not expect too much of an overload from it. The 2-inch pipe requires from one to three hours to heat up.

The secondary wire is attached to the water pipes by being wrapped with a short piece of No. 8 bare aluminum of which there is a supply of scrap on hand. Variations from the usual sometimes occur. At times a transformer on the line is handy and may be used in place of that on the sleigh. In one case, after disconnecting the ground connection, we have attached the line side of the 110-volt service in the cellar direct to the water pipes. In this way the current flowed to the ground connection of a neighbor and registered 62 amperes without resistance. This house had No. 6 wire in the service conduit and was fed from the 20-kw. transformer.

Nor is the use of electrical thawing confined to water pipes alone. We frequently are requested to thaw soft-water pipes, soil pipes, and even sewer pipes. In Guelph, last winter, an underground cable was thawed in a conduit which had been flooded and frozen. Fifty amperes loosened this cable in thirty minutes, after steam had been tried for two days.

As the electric and water utilities both come under the one management in Trenton, some thawing jobs are charged direct to the water department. In cases where the consumer bears the expense, the time of the men and horse and the current used plus a small profit for depreciation of the apparatus, has averaged in the past between \$1.50 and \$2.25. This compares very favorably with the prices in Binghamton, N.Y., where the average return for each job was \$13 with a minimum of \$10.

The average number of thawing jobs completed in one day would range from six to twelve, depending upon how they might be grouped. Where the electric department is entirely distinct from that of the water department, there should be a good revenue netted from this work. There is also the satisfaction of supplying a timely service to the people.

## RAILWAY EQUIPMENT CONTRACTS

The government has given the following details in the House of Commons regarding the \$32,966,515 orders recently placed for railway equipment:—

Canada Car & Foundry Company, 5,000 forty-ton steel frame box cars, \$13,750,000; National Steel Car Company, 1,000 cars, \$2,750,000; Eastern Car Company, 750 forty-ton flat cars, \$1,777,800; Eastern Car Company, 650 fifty-ton coal cars, \$2,066,675; Hart-Otis Company, 250 side-dump cars, \$760,000; Hart-Otis Company, 200 side and centre-dump cars, \$625,000; Pressed Steel Car Company, 25 general service tanks, \$134,956; Pressed Steel Car Company, 25 water service tanks, \$129,593; Canada Car & Foundry Company, 250 refrigerator cars, \$1,024,250; Pullman Car Company, 14 sleeping cars, \$502,460; Pullman Car Company, 7 dining cars, \$238,700; Montreal Locomotive Works and Canada Locomotive Company, 50 consolidated freight engines, \$2,900,000; 10 switching engines, \$405,000; 30 Pacific type engines, \$1,800,000; 50 Mikado type engines, \$3,720,000; Canada Locomotive Company, 6 switching engines, \$246,000; 4 narrow-gauge engines, \$136,080.

## MORE EQUITABLE CONTRACTS BETWEEN HIGHWAY COMMISSIONS AND CONTRACTORS\*

By James C. Travilla

Consulting Highway Engineer of the Dunn Wire Cut Lug Brick Company.

THE relations of the contracting parties to a contract for highway construction are closely allied; they should be co-operative and their joint efforts should be constructive. Unfortunately, at times, the duties and responsibilities of highway commissioners are not properly interpreted, or are limited by laws which make it difficult to successfully direct, finance and construct highways on a basis equitable to both parties to the contract.

The highway commissions' duties frequently are prescribed by laws which are inadequate, inelastic or mandatory. The commissioners, in their capacity as trustees for the public in the expenditure of road funds, are not in a position to deal with contractors in the same manner as though they were directing or adjusting a private business transaction. This limitation can be appreciated only by those who have held public office. The highway commissions, in providing for the construction of a system of highways to meet traffic requirements and in keeping within the financial limitations, prescribe definite plans and specifications, form of contract, bidding blank and estimates of cost, etc. The specifications for highway construction have been very generally standardized. The conditions and stipulations entering into contracts and specifications, together with their interpretation, have not. The estimates of cost of work frequently are based on incomplete or indefinite information regarding the cost of labor and material, average haul, approximate quantities, available water supply, suitable railroad facilities for receiving and unloading material, etc. These uncertainties have resulted in introducing an element of risk to contractors bidding on highway work.

Highway commissioners and contractors in estimating cost of work have not given sufficient attention to the fixed, overhead, incidental and plant expenses, labor and material market and cost data. The result has been low estimates and low bids, with unsatisfactory results to both parties, which have brought about a desire for a more equitable contract. The fixed, overhead, incidental and plant charges are very significant items in highway construction. Under this head may be properly classed the following:—

Cost of bidding, contract bond, liability insurance, legal expenses, interest on deferred payments, discounting paper, travelling expenses, home and local office expenses, cost keeping, demurrage, miscellaneous freight and express charges, equipment charges, depreciation on equipment, moving equipment, tools lost, broken or stolen, loss due to weather conditions, damage to work by elements, pay roll expense during rainy and cold weather, watchmen, labor shortage, loss in damaged cement sacks, delays due to breakdowns and material shipments, cost of inspecting material, damage to private property, water charges, boarding and transporting men, entertainment, etc.

The above items do not represent imaginary or accidental expenses connected with highway construction,

\*Paper read before the annual convention of American Road Builders' Association.