tension in an unprofitable territory, and more demands for new methods of carrying on the business, but in every way the public may take what would be the only increment of the capital invested. The result in Boston has been that the permanent investment has increased to more than six times the gross revenue. It, therefore, appears extremely difficult to carry on business and satisfactorily meet public demands in the United States.

In Canada conditions between the railways and the public are not exactly similar to those in the United States. Nevertheless, there is a sufficiency of resemblance in the attitude of the public mind to make it well worth our while to note and endeavor to profit by the struggles, successes and failures of our neighbors to the south.

OTTAWA'S WATER SUPPLY.*

Writing in a letter to Mayor Ellis, Dr. C. A. Houston suggests that tests of the water of the Gatineau Lake be made by Mr. Joseph Race, the city bacteriologist. The following is an extract of Dr. Houston's letter: "On the assumption that the lake scheme of supply is provisionally adopted, it will be necessary to carry out the prolonged series of bacteriological, chemical and physical investigations as regards the quality of the water in the lake or lakes likely to be chosen for supply purposes. For the engineering part of the work, Sir Alexander Binnie will, no doubt, send out a competent surveyor; for my part, so far as quality is concerned, I have every confidence in the ability of Mr. Race to carry out the work successfully and to furnish me with such results and reports as will enable me ultimately to pronounce judgment in the matter. The bacteriological side of the question is not so important, as, with the gathering ground freed from all human sources of pollution, there is no possibility of the water conveying disease. Physical and chemical tests, on the other hand, are most important, and the water should also be examined for algæ. It will be necessary to collect samples periodically from the lake or lakes likely to be eventually chosen at various spots, and possibly at different depths, and accurate records must be kept of color, hardness, alkalinity, presence or absence of suspended matter, conditions as regards algal growths, temperatures, presence of iron, etc."

* Dr. Houston and Sir Alexander Binnie, the British experts engaged to report on Ottawa's water supply.

FOREST PROTECTION.

A very important conference upon the matter of forest protection along the lines of operating railways in the West has just closed at Winnipeg, the British Columbia Department of Forestry having been represented by Mr. R. H. Benedict, of the headquarters staff, and the parties to the convention being the federal Board of Railway Commissioners, the Province of British Columbia, the Canadian Pacific, the Grand Trunk Pacific, Canadian Northern and Great Northern Railway Companies. General protection of timber along the rights-of-way was the theme of discussion. Last year every mile of right-of-way was inspected by the provincial officers, and the regulations strictly enforced to guarantee the safety of near forests and due payment of royalty for timber cut on Crown lands. The work of inspection is peculiarly onerous in connection with construction operations, and, on the whole, the provincial officers have been well supported by the railway companies. The rule has been laid down that everything cut without permit is considered to constitute a trespass, and where timber is cut, with or without permit, the brush must be properly disposed of without delay.

EXHAUST STEAM AND ITS UTILIZATION AT COLLIERIES AND MINES.

An interesting paper on the above subject was recently presented by J. M. Gordon, at the annual meeting of the Canadian Mining Institute. In the course of his paper Mr. Gordon stated that up to within comparatively recent years the loss of the exhaust steam, and the amount of live steam that was carried down the mine to haulage engines and pumps received scant attention by mining engineers. There was, until recently, no demand for the small sizes of coal from the dry screening plant, and the silt and sludge from the washery; it was argued, therefore, that it was just as well to burn the small sizes in the boilers, than to dump it in a corner of the colliery yard where it would be in the way and an eyesore. Conditions have now changed. This silt, sludge, culm and buckwheat is no longer valueless. Coking plants, briquetting plants and mechanical stokers must now be fed, while competition and the steady increase in working expenses have made the problem of power distribution in and around mines one of considerable importance. To-day more than ever, the law of the survival of the fittest applies. It is the day of the electrical unit. Thus in many of the more advanced mines in Great Britain and on the Continent, we no longer find those huge old Cornish pumps, grinding and groaning as if in agony; no longer thousands of thermal units going to waste as a result of conducting steam pipes down deep and wet shafts to haulages; no longer long transmission lines of compressed air under ground to distant coal cutters. The day for these has passed. In their place we find high lift centrifugal pumps driven at from 1,500 to 2,000 revolutions per minute; three-phase high-tension armored cables passing down the shaft; and the transformation of the current near the distant coal-cutters to drive an inbye air compressor, or to work the coal-cutters by electricity direct. And this electric power has been generated from the exhaust steam formerly disregarded and wasted.

Meanwhile condensers cannot be used with reciprocating winding engines on account of the difficulty in controlling them; and the compounding of existing reciprocating engines, and the installation of condensing plant gives such a narrow margin of profit with a disproportional increase of worry to the management, together with so heavy an initial expenditure, that it has been found preferable to run these engines non-condensing. But the advent of the exhaust and mixed pressure turbine has made it possible to utilize this hitherto tremendous waste of heat units by converting them into electric units.

Before describing, however, the application and the possibilities of this new power producer, it may be advantageous to first point out the chief differences between the reciprocating engine and the turbine, and to indicate when and how thew should be placed. In the case of the reciprocating engine, the heat units are, by their expansion in a cylinder and change of configuration, made available for useful work through the medium of a fly-wheel; while in a turbine this transformation of static heat energy into kinetic energy may be brought about in one of three different ways: (1) In the impulse turbine by the expansion of the steam in nozzles, impinging on buckets on the periphery of the turbine wheel, which in turn levers the shaft and attains as high a speed in some sizes as 30,000 revolutions per minute; (2) In the reaction turbine, by the alternate passage of the steam through revolving and fixed blades the expansion is performed on both sets of blades, the fixed blades acting as guides; and (3) the operation is performed by means of a combination of the first and the second.

Theoretical thermodynamics teach that when a given quantity of steam at a given pressure and temperature ex-