

Eighth Question—Authorities in Charge of the Construction and Maintenance of Roads—Functions of Central Authorities and Local Authorities.

"A principle that can be laid down as of universal application is, that the unit of highway administration shall be sufficiently large and command sufficient resources to employ and adequately remunerate a competent staff.

Ninth Question—Finance of the Construction and Upkeep of Roads—Provision of Revenues.

"The expenditure on the maintenance and improvement of roads which are used mainly by long-distance traffic, unless such expenditure is borne wholly out of the national revenues under a system of State administration of roads (which system is practicable and suitable in the case of some roads in some countries) should be mainly paid for out of national revenues, whether or not such roads are locally administered and maintained, subject, where local administration prevails, to the supervision of a central government authority, both as to efficiency and expenditure.

"It is desirable to abolish, so far as possible, all tolls on public roads, but it is equitable that vehicles which, on account of their weight or weight combined with speed, or any other exceptional circumstances connected with either the vehicle or use of the road, cause special damage to roads beyond the wear and tear of the ordinary traffic of any district, should be subject to special taxation the proceeds of which should be earmarked for expenditure on roads.

"Borrowing money for new road construction and for the periodic renewal of the surface coating of a road is consistent with sound financial principles provided that the loan period in the case of loans for renewals, is kept well within the life of the surface coating."

Even a brief summary of the work of the Third International Road Congress should not be closed without reference to the hospitality and elaborate series of entertainments and excursions provided by our British cousins and the officials of the Permanent International Association of Road Congresses.

A new generating station will be opened shortly at West Hartlepool, England, which claims to be the first municipal authority to produce electricity by means of waste heat, says a Consular report. The two turbo-generators, each of 1,500 kw., will be driven by exhaust steam from the furnace-blowing engines of the Seaton Carew Iron Co., adjacent to whose works the station is built. In return for their exhaust steam, which has hitherto been blowing to waste in the air, the Seaton Carew Iron Co. will receive current free from the corporation. Expenditure on coal will practically be eliminated. The coal bill for the present electricity station is about \$20,000 a year, and, as it is anticipated that the consumption of current will largely increase under the cheaper rate now possible, the ultimate saving by the use of waste heat will be very considerable. Should the supply of exhaust steam not be available, either through a breakdown of the blowing engines or through the iron works being idle, a supply of high-pressure steam will be obtainable from the Seaton Carew Iron Co. The total expenditure involved in connection with the new scheme is \$188,500, the plant alone having cost \$150,000. The old generating station will be maintained as a stand-by and as a town substation. There the current from the new station will be transformed to the voltage required for distribution to the town.

SPECIFICATIONS FOR FUEL FOR HEAVY-OIL ENGINES.

THE United States Bureau of Mines has carried on a careful investigation to ascertain some means of more effectively burning heavy asphaltum oils as fuels for steam raising and for internal-combustion engines. The result of the extended search appears in pamphlet form as a bulletin recently issued, and entitled "Heavy-Oil as Fuel for Internal-Combustion Engines," by Irving C. Allen. From this investigation the consensus of opinion seems to be that an oil, to be burned with success in these engines, should possess the following characteristics:—

Solidifying Point.—The oil should be mobile at 60° C. If it be heavy or viscous or contain a considerable proportion of asphaltum or paraffin, it will become sluggish and stiff at low temperatures, and considerable heat will have to be used to warm it before it can be run into the engine.

Fluidity.—Sluggish oils should first be heated before being introduced into the engine. If it be necessary to use very heavy oils, the engine should first be warmed by running on a more fluid fuel and the heavy oil introduced only after the engine is hot and running well. This process should be reversed when shutting down, and the heavy oils should be washed out of the engine valves and pipes with a lighter oil, the engine being run a short time on one of these lighter oils before it is allowed to become cold.

Tar Content.—An oil should contain not more than 0.4 per cent. of material insoluble in xylene, as a larger proportion of insoluble material will tend to form coke in the cylinders. (Ten grams of the sample mixed with 10 cubic centimeters of xylene shaken and filtered should show not more than 0.04 gram increase on the filter.)

Coke Residue.—The residue on coking should be not greater than 3 per cent. A high content of asphaltum or free-carbon will give considerable trouble by coking in the cylinders.

Free-Carbon Content.—There should be not more than a trace of free carbon in the oil, as free carbon tends to clog the valves and to deposit on the surfaces of the cylinders.

Volatility.—At least 80 per cent. of the oil should distil over at 350° C., for oil leaving more than 20 per cent. residue at this temperature will show a large carbon content by coking.

Distillation.—Heavy oils and residues, though they may be successfully burned in a heavy-oil engine, should properly be distilled (not refined) before using, as it is cheaper to prepare the oil before introducing into the engine than it is to dismantle the engine, or a part of it, for cleaning.

Flash Point.—The flash point should be between 60 and 100° C. (closed tester). A small proportion of oil of a low flash point is required to insure ignition.

Ignition Oil.—In general a heavy oil containing no material having a low flash point should be enlivened by the addition of about 2 per cent. of a "gas oil," flash point 60 to 100° C. or less, before being fed into the cylinders.

Specific Gravity.—The specific gravity in itself, although of little significance, should be not greater than 0.920, because when greater the large proportion of heavy