internal and external, among such roller bearings. Some are enough shorter than solid bearing housings that a detector aimed to scan solid bearings in optimum fashion may miss such roller bearings, particularly when there is an unfavorable combination of bearing type, side sway, wheel size or rim thickness. Such a bearing will give a detector indication which does not correspond accurately to its temperature rise.

Even if these bearings are scanned properly, they give indications which differ from those of normal solid bearings. Since the roller bearing housing is itself the outer race of the bearing, the scanner sees directly one of the parts which is generating heat. The scanned part of the normal roller bearing therefore has a much higher temperature rise than the scanned part of a solid bearing. Some of these bearings also have a cap bolted directly to the end of the journal and in intimate thermal contact with the axle, which is seen directly by the scanner. This also has a high temperature rise on a normal bearing.

Finally there are some roller bearings which generate somewhat more heat than plain bearings, and on these the journal, wheel hub, and side frame, as well as the housing may have higher temperature rises than on normal solid bearing trucks.

These variations in roller bearing indications have seriously hampered the adoption of automatic evaluation equipment for use with hotbox detectors. The heart of the problem is that different temperature criteria must be used for solid bearings and roller bearings, but there is nothing which can reliably tell evaluation equipment which bearing is of which type. RSC

It is characteristic of the use of hotbox detectors that the various aspects of work associated with them do not fall neatly into the scope of any one department's responsibilities. Car inspectors must check bearings which have been tabbed as overheated, train crews must look for hotboxes when trains are stopped on line-of-road, signalmen must provide maintenance of detectors, men from the communications group must plan and maintain data transmission equipment. The criteria for normal and abnormal bearings must be established by the mechanical department, but the detector performance to meet those criteria must be reached and maintained by electronics people. Close cooperation and interchange of information between the proper groups are essential right from the planning stage for the first installation through the continuing day-to-day operation after units are in service.

The variations in roller bearing indications described above point up the need for more information about the thermal performance of roller bearings, both when they are normal and when they have defects.

The information now available, both analytical and experimental, about the thermal performance of bearings is valid only under steady state conditions. But in the case of most hotboxes, an unstable condition has been created in which the temperature runs away. As the temperature increases, the heat being generated increases, until ultimate failure takes place. In this process the heat capabilities of the wheel, axle and truck members play a major part. A study of what happens during this process would be a valuable contribution to knowledge of bearing performance and of the use of infrared hotbox detectors.

COMPUTER SIMULATION OF CTC

A computer simulation of CTC operations developed by the operations research department of the Canadian National has been close enough to actual train operation so that the technique has been an aid in planning CTC installations and siding extensions and retirements on existing CTC subdivisions. (**Editor's Note**: A full length feature article on this CN project will appear in a forthcoming issue of *Railway Signaling and Communications*.) In the past the installation of CTC involved painstaking and time-consuming work in the redispatching as to how trains would be operated under CTC. This would be necessary to determine the most economic number and locations of signaled sidings which would adequately handle the current and anticipated traffic. C. J. Hudson, operations research analyst, CN, reported that the computer technique of simulation developed by CN's operations research department enables the transportation department to evaluate various siding configurations easily and quickly and to compare alternatives quantitatively.

He said the present program has limitations, some of which are due to the memory size of the IBM 650 computer. At present a section with not more than 38 sidings can be simulated. This will be increased when use is made of the 7070 computer. The simulation program for the 7070 is now being developed.

A more general simulation of railroad operations is also planned. In this it is intended to simulate traffic over a large network, such as Montreal and Toronto to Winnipeg, and to incorporate in the simulation the operation of major yards. This kind of simulation can be applied directly to problems of scheduling between major terminals and could be used to study the effect on operating efficiency of varying the number and length of trains. There is also very little understanding of the theory of traffic flow on a single track. The more detailed CTC simulation will be used to investigate the relationships between over-all interference and the factors of traffic density, siding spacing, train priority and velocity. RSC

TORONTO SUBWAY CAR COMMUNICATIONS

One of the features of the Toronto Transit Commission's new 74-ft aluminum subway cars is the communications system, which will provide: (1) Simplex communication from car to wayside; (2) public address communication from wayside to passengers in all trains; (3) public address communication from the motorman to passengers on his train; (4) duplex communication between motorman and guard on a train. The first two functions are on a shared or party line basis, while the last two are available at all times.

According to I. G. Hendry, TTC, and D. H. Hellmann, Vapor Heating Ltd., the equipment operates on an amplitude modulated carrier frequency of 72 kc. Transmission from the wayside unit is via a special telephone wire pair linked to the contact rail by coupling units spaced at ¼-mile intervals. Coupling units on the cars connect the contact shoes to the transmitter receiver unit.

The train equipment mounted in the motorman's cab includes a portable transceiver unit (comprising transmitter, receiver and power amplifier), a telephone selector unit, and a public address amplifier feeding six loudspeakers mounted above the ceiling. A loudspeaker is provided in the cab which monitors all outside calls. This function is transferred to the handset earpiece when the motorman selects to call or reply. RSC