No magnesium was found in the steels. The analyses were made for all elements likely to be alloyed with iron. The iron content quoted is a measurement and is not determined by difference. The fact that the total percentages do not add up to 100% is due mainly to errors in measurement of the iron content rather than the presence of another element. The greatest error would be expected in the magnetic material where the presence of pearlite causes low readings for iron.

Some variations in composition were found within the samples, mainly in measurements of the carbon content of the magnetic metal. Values varying from 0.15% to 0.4% were found. The reason for these variations is that the cast structure contains large ferritic and pearlitic areas, either of which would have a major influence on a carbon analysis made over a small area, the ferrite giving a low and the pearlite a high reading. These errors show up especially if the microstructure is used to measure the carbon content since the area observed is small relative to the microstructural variations. Analysis of large areas and microstructural analysis of a specimen heat treated to give a finer homogeneous structure showed that the true carbon content was about 0.2%.

Variations in other elements was less than 10% of the amounts present for both magnetic and non-magnetic samples.

Neither of these analyses gives cause for surprise. The composition of the magnetic sample is similar to AISI steel specification 50B.20, a low-carbon, low-chromium, boron steel. Manganese steels are not given specification numbers but the composition of the non-magnetic material is within the specifications for Hadfield's manganese steel, namely 1.0-1.4% carbon, 11-14% manganese, 0.2-1.0% silicon. The amount of chromium most commonly found in manganese steels to which chromium is added is 1.5-2%, higher than the 0.75% in this steel. However, austenitic manganese steels containing less than 1% chromium are commonly cast by at least one foundry in the Province of Quebec. It is therefore reasonable to suppose that the non-magnetic material is a low-chromium Hadfield's manganese steel.

The trace elements found in both metals are typical of those generally found in steels. Boron is sometimes added to steels in small quantities to improve hardenability, and so is not truly a trace impurity.

X-ray Analysis

A sample of the non-magnetic metal was examined by X-ray diffraction and found to be austenite, i.e., face-centred cubic iron, as in austenitic manganese steels.

Scrapings from Surface

Some of the particles adhering to the outside surfaces of the samples