

*Pouring blown matte from one of the converters. After casting and breaking up, the matte is shipped to Johnson Matthey for the extraction of copper, nickel and the six platinum metals*

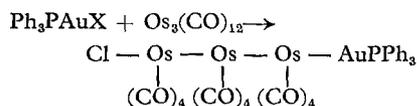
From this refinery, which has of course been enlarged in line with the Rustenburg expansions, the six platinum metals are supplied in pure form to independent fabricators and catalyst manufacturers and to the Johnson Matthey group of companies throughout the world.

it involves their precipitation as complex salts followed by successive stages of recrystallisation and then by calcination under carefully controlled conditions in electrically heated muffle furnaces, to produce the metals in the form of sponges or powders suitable for melting.

Throughout all the stages of extraction and refining new and improved methods are under constant development, and the numerous extensions to plant both at Rustenburg and in the Johnson Matthey refineries have been designed to take full advantage of more sophisticated metallurgical techniques.

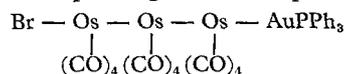
## Osmium Complexes Containing Four Metal Atoms

The preparation of interesting new complexes containing four metal atoms has been reported by C. W. Bradford, of the Johnson Matthey Research Laboratories, working under the guidance of Professor Sir Ronald Nyholm (*Chem. Comm.*, 1968, 867). These are obtained by reacting osmium carbonyl,  $\text{Os}_3(\text{CO})_{12}$ , with triphenylphosphine gold halides. It appears that only one of the three Os-Os bonds in the original triangular cluster is broken and this gives rise to what is possibly the first case of a linear arrangement of four covalent bonded metal atoms:



This new compound is red in colour, monomeric and a non-conductor in solution, and has an infra-red spectrum in the C-O stretching region which is consistent with a linear arrangement of the Au-Os-Os-Os moiety.

The corresponding bromo-compound:



has also been isolated and has properties similar to those of the chloride.

If X-ray crystallographic studies at present being made show that a linear arrangement is indeed present, then it is interesting to speculate on the possibility of synthesising from these compounds other compounds containing even longer chains of metal atoms.