The reactions of the ether salts \([(\eta^5-C_5R_5)(CO)_2Fe(E)]BF_4\), (R = H, E = Et_2O; R = CH_3, E = THF) with various ligands possessing two different coordination sites have been investigated. It was established that \([(Cp(CO)_2Fe(OEt_2)]BF_4\) (Cp = \(\eta^5-C_5H_5\), 1, and \[Cp^*(CO)_2Fe(THF)]BF_4\) (Cp* = \(\eta^5-C_5(CH_3)_5\), 2, react with 1-aminopropanol, 4-methoxybenzylamine and 3-aminopropyltriethoxysilane to give only mononuclear complexes of the type \([(\eta^5-C_5R_5)(CO)_2Fe(L)]^+\), irrespective of the reactant ratios. On the other hand, the reaction of 1 with one equivalent of 4-aminobenzonitrile (ABN) furnished both mononuclear and dinuclear complexes, \([Cp(CO)_2Fe(ABN)]^+\) and \([\{Cp(CO)_2Fe\}_2(\mu-ABN)]^{2+}\) isolated as tetrafluoroborate salts, with the mononuclear complex being the major product. The reaction of \([(\eta^5-C_5R_5)(CO)_2Fe(E)]BF_4\) with 1,4-phenylenedimethanamine (PDA) afforded only the dinuclear complex \([\{\eta^5-C_5R_5)(CO)_2Fe\}_2(\mu-PDA)]^{2+}\) regardless of the reactant ratios. The reaction of 2 with one equivalent of the compound \([Cp(CO)_2Fe(ABN)]BF_4\) gave the mixed ligand salt \([Cp(CO)_2Fe(ABN)Fe(CO)_2Cp^*](BF_4)_2\). The reactions of dipropylamine with \([Cp(CO)_2Fe(OEt_2)]BF_4\) gave the dipropylamine salt \([Cp(CO)_2Fe(NH(CH_2CH_2CH_3)_2)]BF_4\). All these compounds are reported for the first time and have been fully characterized by \(^1\)H NMR, \(^{13}\)C NMR, IR spectroscopy and elemental analysis. Molecular structures of \([Cp(CO)_2Fe(NH(CH_2CH_2CH_3)_2)]BF_4\), \([Cp^*(CO)_2Fe(NH(CH_2CH_2CH_3)_2OH)]BF_4\) and \([Cp^*(CO)_2Fe(NH_2C_6H_4OCH_3)]BF_4\) have been confirmed by single crystal X-ray crystallography.