The reactions of the ether salts $[(\eta^5\text{-}C_5R_5)(CO)_2Fe(E)]BF_4$, (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 = $\eta^5\text{-}C_5H_5$), **1**, and $[Cp^*(CO)_2Fe(THF)]BF_4$ (Cp^* = $\eta^5\text{-}C_5(CH_3)_5$), **2**, react with 1-aminopropanol, 4-methoxybenzylamine and 3-aminopropyltriethoxysilane to give only mononuclear complexes of the type $[(\eta^5\text{-}C_5R_5)(CO)_2Fe(L)]^+$, 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 $[\{Cp(CO)_2Fe\}_2(\mu\text{-ABN})]^{2+}$ isolated as tetrafluoroborate salts, with the mononuclear complex being the major product. The reaction of $[(\eta^5\text{-}C_5R_5)(CO)_2Fe(E)]BF_4$ with 1,4-phenylenedimethanamine (PDA) afforded only the dinuclear complex $[\{(\eta^5\text{-}C_5R_5)(CO)_2Fe\}_2(\mu\text{-PDA})]^{2+}$ 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 $[Cp(CO)_2Fe\{NH(CH_2CH_2CH_3)_2\}]BF_4$, $[Cp^*(CO)_2Fe\{NH_2(CH_2)_2CH_2OH\}]BF_4$ and $[Cp^*(CO)_2Fe(NH_2C_6H_4OCH_3)]BF_4$ have been confirmed by single crystal X-ray crystallography.