$$\begin{CD}
\Omega(A) @>{\iota_A}>> P_A @>{\pi_A}>> A \\
@V{\Omega(f+g)-\Omega(f)-\Omega(g)}VV @V{p_{f+g}-p_f-p_g}VV @V{f+g-f-g=0}VV \\
\Omega(B) @>{\iota_B}>> P_B @>{\pi_B}>> B
\end{CD}$$

with diagonal dashed arrow ϕ from P_A to $\Omega(B)$.