Let σ, θ be commuting involutions of the connected reductive algebraic group G where σ, θ and G are defined over a (usually algebraically closed) field k, $k \neq 2$. We have fixed point groups $H := G^{\sigma}$ and $K := G^{\theta}$ and an action $(H \times K) \times G \to G$, where $((h, k), g) \mapsto hgk^{-1}$, $h \in H$, $k \in K$, $g \in G$. Let $G//(H \times K)$ denote $O(G)^{H \times K}$ (the categorical quotient).

Let A be maximal among subtori B of G such that $\theta(s) = \sigma(s) = s^{-1}$ for all $s \in B$. There is the associated Weyl group $W := W_{H \times K}(A)$. We show:

1) The inclusion $A \to G$ induces an isomorphism $A/W \to G//(H \times K)$. In particular, the closed $(H \times K)$-orbits are precisely those which intersect A.

2) The fibers of $G \to G//(H \times K)$ are the same as those occurring in certain associated symmetric varieties. In particular, the fibers consist of finitely many orbits.

We investigate the structure of W and its relation to other naturally occurring Weyl groups. We also consider the case where $k = R$.