On some semigroup constructions

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Let $(G,\cdot)$ be a linearly ordered commutative group and e be the unity of G. We define $G^+ = \{x \in G \mid e \leqslant x\}$.

On the set $B_G = G \times G$ ($B_G^+ = G^+ \times G^+$) we define the semigroup operation as follows:

$$(a,b) * (c,d) = \left(a \cdot c \cdot (\min\{b,c\})^{-1},\ b \cdot d \cdot (\min\{b,c\})^{-1}\right).$$

Algebraic properties of the semigroups B_G and B_G^+ will be discussed.

Let τ be a group (semigroup) order topology on G. We shall discuss semigroup topologizations τ_B (resp. τ_{B^+}) of the semigroup B_G (resp. B_G^+) which are extensions of the topology τ and discuss topological and algebraic properties of (B_G, τ_{B^+}) and (B_G^+, τ_{B^+}) as topological semigroups.