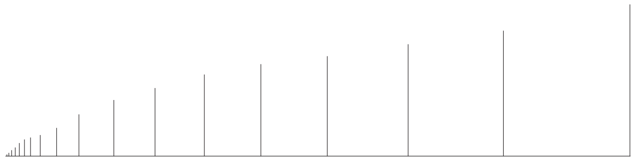

Figure 1.3.4: ( A ) comb $W_R$

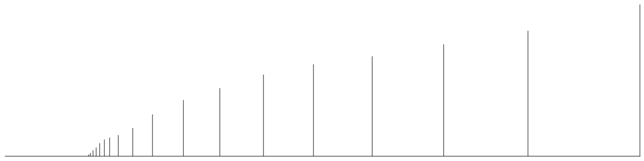

Figure 1.3.4: ( B ) comb $W$

2. A dendrite has the set of all its end points closed if and only if it contains neither a copy of $F_\omega$ nor of $W$, [Arévalo et al. 2001, Corollary 5.4, p. 11].

### 1.3.5 Universal dendrites

As it was mentioned in Property 1 in 1.3.3 the locally connected fan is universal in the class of all $n$-ods, where $n \in \mathbb{N}$. Now we recall the construction of the Ważewski universal dendrite $D_\omega$ and some other dendrites that are universal in various classes of these curves.

### 1.3.6 Ważewski universal dendrite

By the *Ważewski universal dendrite* $D_\omega$ we mean a dendrite $D_\omega$ such that each ramification point of $D_\omega$ is of order $\omega$ and for each arc $A \subset D_\omega$ the set of ramification points of $D_\omega$ which belong to $A$ is dense in $A$. Its construction, known from [Whyburn 1942, Chapter K, p. 137] (compare also [Menger 1932, Chapter X, Section 6, p. 318]), is the following.

Let $X_1^{(\omega)} = F_\omega$. At the midpoint $c$ of each maximal free arc contained in $X_1^{(\omega)}$ (obviously the arc is a straight line segment) attach a sufficiently small copy of $F_\omega$ so that $c$ is the only common point of $X_1^{(\omega)}$ and of the attached copy. Denote by $X_2^{(\omega)}$ the union of $X_1^{(\omega)}$ and of all attached copies. Thus $X_2^{(\omega)}$ is a dendrite. At the midpoint of each maximal free arc contained in $X_2^{(\omega)}$ we perform the same construction, i.e., we attach a sufficiently small copy of $F_\omega$ so that $m$ is the only common point of $X_2^{(\omega)}$ and of the attached copy. Denote by $X_3^{(\omega)}$ the union of $X_2^{(\omega)}$ and of all attached copies. Thus $X_3^{(\omega)}$ is a dendrite. Continuing in this way we obtain an increasing sequence of dendrites