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here a pair is trivial, so we have the same homotopy groups (with another dimension shift) as D. The other octuple similarly reduces to A.

Thus we have 12 sequences of groups, which lie in 15 exact sequences; these we write as

$$
\begin{tikzcd}[column sep=small]
 & B_1 \arrow[dr] & & D_3 \arrow[dr] & & F_1 \arrow[dr] & & B_3 \arrow[dr] & & D_1 \arrow[dr] & & F_3 \arrow[dr] & & B_1 \arrow[dr] & \\
A \arrow[ur] \arrow[r] \arrow[dr] & B_2 \arrow[r] & C \arrow[ur] \arrow[r] \arrow[dr] & D_2 \arrow[r] & E \arrow[ur] \arrow[r] \arrow[dr] & F_2 \arrow[r] & A \arrow[ur] \arrow[r] \arrow[dr] & B_2 \arrow[r] & C \arrow[ur] \arrow[r] \arrow[dr] & D_2 \arrow[r] & E \arrow[ur] \arrow[r] \arrow[dr] & F_2 \arrow[r] & A \arrow[ur] \arrow[r] \arrow[dr] & B_2 \arrow[r] & C \\
 & B_3 \arrow[ur] & & D_1 \arrow[ur] & & F_3 \arrow[ur] & & B_1 \arrow[ur] & & D_3 \arrow[ur] & & F_1 \arrow[ur] & & B_3 \arrow[ur] &
\end{tikzcd}
\tag{10}
$$

where

$$B_i \to C \to D_i\,, \quad D_i \to E \to F_i\,, \quad F_i \to A \to B_i \ (i = 1, 2, 3) \text{ and}$$
$$B_i \to D_j \to F_k$$

((i, j, k) a permutation of $(1, 2, 3)$) are the 15 sequences. Here we have set

$$
\begin{aligned}
A &= \Pi_{n+1}(\Psi)\,, & B_1 &= \Pi_n(A)\,, & B_2 &= \Pi_n(B, D)\,, \\
B_3 &= \Pi_n(C, D)\,, & C &= \Pi_n(A, D)\,, & D_1 &= \Pi_{n-1}(D)\,, \\
D_2 &= \Pi_n(A, B)\,, & D_3 &= \Pi_n(A, C)\,, & E &= \Pi_n(\Phi)\,, \\
F_1 &= \Pi_n(X)\,, & F_2 &= \Pi_{n-1}(C)\,, & F_3 &= \Pi_{n-1}(B)\,.
\end{aligned}
$$

This diagram also contains an immense number of diagrams (4), each with two Mayer-Vietoris sequences (8): we shall not go into any more details.

REFERENCES

[1] S. Eilenberg and N. E. Steenrod, *Foundations of Algebraic Topology*. Princeton, 1952.