Claims

1. Process for preparing C_8 olefins and C_{12} olefins by oligomerization of butenes, comprising the following step sequence:

a) providing of a hydrocarbon mixture comprising (i) at least one 2-butene selected from the group consisting of cis-2-butene and trans-2-butene, and also (ii) at least one further linear butene selected from the group consisting of cis-2-butene, trans-2-butene and 1-butene other than ~~this~~ the 2-butene in (i);

b) oligomerizing of a part of the butenes present in the hydrocarbon mixture, to give C_8 olefins and to give C_{12} olefins and optionally to give C_{12+} olefins, by contacting of the hydrocarbon mixture with an oligomerization catalyst arranged in a reaction zone, at a reaction temperature prevailing in the reaction zone, to give an oligomerizate comprising the prepared oligomers and the unreacted butenes;

c) removing of the unreacted butenes from the oligomerizate;

~~d) optionally, recycling of a part of the removed unreacted butenes to the preceding oligomerization;~~

the step sequence being carried out at least once with inclusion of ~~the~~ a "recycling" step d),

wherein recycling step d) comprises recycling of a part of the removed unreacted butenes to the preceding oligomerization,

wherein the hydrocarbon mixture provided for the first time is a reactant mixture having the following composition, which adds up to 100 wt%:

1-butene:	less than 10 wt%, preferably less than 5 wt% and more preferably less than 2 wt%
2-butenes:	20 to 90 wt%
isobutene:	less than 5 wt%, preferably less than 1 wt%
n-butane:	less than 80 wt%
isobutane:	less than 80 wt%
others:	less than 5 wt%, preferably less than 2 wt%,

~~characterized~~

~~in that~~ wherein in the step sequence carried out for the first time, the concentration of 1-butene in the provided hydrocarbon mixture, based on the concentration of linear butenes, is less than or equal to the equilibrium concentration of 1-butene, resulting from the reaction temperature of the step sequence carried out for the first time, within the fraction of the linear butenes present in the hydrocarbon mixture provided for the first time,

~~in that~~ wherein the C_8 olefins prepared are obtained as a C_8 product mixture whose Iso index is less than 1.2,

and ~~in that~~ wherein in the step sequence carried out for the first time, the conversion of butenes, assessed directly over the first reaction zone, is limited to a first limit value of between 5 and 40 wt%, this value lying preferably between 10 and 38 wt% and very preferably between 10 and 36 wt%.

2. Process according to Claim 1, the "providing, oligomcrizing, rcmoving and recycling" step sequence being carried out at least two times one after another, ~~characterized~~
~~in that~~ wherein in the second step sequence carried out, the conversion of butenes, assessed directly at the second reaction zone, is limited to a second limiting value of between 5 and 50 wt%, said value lying preferably between 10 and 40 wt%.

3. Process according to Claim 2, the "providing, oligomerizing, removing and recycling" step sequence being carried out at least three times one after another, ~~characterized~~
~~in that~~ wherein in the third step sequence carried out, the conversion of butenes, assessed directly at the third reaction zone, is limited to a third limiting value of between 5 and 65 wt%, said value lying preferably between 20 and 60 wt%.

4. Process according to Claim 3, the "providing, oligomerizing, removing and recycling" step sequence being carried out at least four times one after another, ~~characterized~~
~~in that~~ wherein in the fourth step sequence carried out, the conversion of butenes, assessed directly at the fourth reaction zone, is limited to a fourth limiting value of between 5 and 80 wt%, said value lying preferably between 20 and 70 wt%.

5. Process according to Claim 4, the "providing, oligomerizing, removing and recycling" step sequence being carried out at least five times one after another, ~~characterized~~ ~~in that~~ wherein in the fifth step sequence carried out, the conversion of butenes, assessed directly at the fifth reaction zone, is limited to a fifth limiting value of between 5 and 95 wt%, said value lying preferably between 20 and 80 wt%.

6. Process according to any of the preceding claims, ~~characterized~~ ~~in that~~ wherein the overall conversion of butenes achieved after all of the step sequences have been carried out is between 5 and 100 wt%, more particularly in that it lies between 20 and 100 wt% and very preferably in that it lies between 30 and 95 wt%.

7. Process according to any of the preceding claims, ~~characterized~~ ~~in that~~ wherein the limiting of the conversion in the respective oligomerization is accomplished by limiting the reaction temperature of the respective oligomerization, more particularly through use of an external cooling medium, to a maximum temperature of between 40°C and 140°C, preferably between 45°C and 120°C and very preferably between 50°C and 100°C.

8. Process according to any of the preceding claims, ~~characterized~~ ~~in that~~ wherein more than 80 wt% of the oligomers prepared are C_8 olefins, more particularly more than 82 wt% and very preferably more than 84 wt%.

9. Process according to any of the preceding claims, ~~characterized~~ ~~in that~~ wherein the composition of the C_8 olefins prepared is as follows, adding up to 100 wt%:

n-octenes:	10 to 25 wt%, preferably 12 to 20 wt% and more preferably 14 to 20 wt%;
methylheptenes:	50 to 80 wt%, preferably 55 to 75 wt% and more preferably 60 to 70 wt%;
dimethylhexenes:	10 to 30 wt%, preferably 10 to 25 wt% and more preferably 10 to 20 wt%.

10. Process according to any of the preceding claims, ~~characterized~~ ~~in that~~ wherein the C_8 product mixture has an Iso index of less than 1.1 and more preferably of less than 1.05.

~~11. Process according to any of the preceding claims, characterized in that the hydrocarbon mixture provided for the first time is a reactant mixture having the following composition, which adds up to 100 wt%:~~

~~1-butene:~~	~~less than 10 wt%, preferably less than 5 wt% and more preferably less than 2 wt%~~
~~2-butenes:~~	~~20 to 90 wt%~~
~~isobutene:~~	~~less than 5 wt%, preferably less than 1 wt%~~
~~n-butane:~~	~~less than 80 wt%~~
~~isobutane:~~	~~less than 80 wt%~~
~~others:~~	~~less than 5 wt%, preferably less than 2 wt%~~

~~12~~11. Process according to any of the preceding claims, ~~characterized~~ ~~in that~~ wherein it is carried out in a plant within which exactly one reaction zone is assigned to each step sequence carried out.

~~13~~12. Process according to any of the preceding claims,
~~characterized~~
~~in that~~ wherein in each traversed step sequence apart from the last step sequence, the non-recycled part of the removed unreacted butenes is provided as a hydrocarbon mixture for the subsequent step sequence.

~~14~~13. Process according to any of the preceding claims,
~~characterized~~
~~in that~~ wherein the part of the removed unreacted butenes not recycled in the last step sequence is productively utilized, this utilization being selected from the following utilization possibilities:

a) total hydrogenation to give a butane mixture;
b) oxidative or non-oxidative dehydrogenation to butadiene;
c) hydroformylation to pentanals;
d) oxidation in particular to maleic anhydride;
e) metathesis;
f) hydration to butanols;
g) alkylation;
h) isomerization;
i) addition reaction of alcohols to ethers;
j) carbonylation;
k) cracking in a steamcracker or in a fluid-catalytic cracker to give hydrocarbons having less than four carbon atoms;
l) combustion to give thermal energy.

~~15~~14. Process according to any of the preceding claims,
~~characterized~~
~~in that~~ wherein the oligomers obtained in the individual step sequences are combined and then separated into the C_8 product mixture, into a C_{12} product mixture and into a C_{12+} product mixture.