the presence of a cobalt catalyst, subsequently separating an unreacted monoolefin from a reaction product, and allowing the unreacted monoolefin, carbon monoxide and hydrogen to react with one another in the presence of a cobalt catalyst is disclosed, and specifically, a codimer of a butene isomer, or the like is used as a raw material.

Citation List

Patent Literature

[0004] Patent Literature 1

Japanese Patent No. 4368454

Patent Literature 2

Japanese Patent Laid-Open No. 2002-53501

Patent Literature 3

UK Patent No. 702204

Summary

Technical Problem

[0005] In the method described in Patent Literature 1, however, the amount of an alcohol produced is large, and the aldehyde selectivity is low, so that the method is practically unsatisfactory.

In the method described in Patent Literature 2 also, the amount of an alcohol produced is large, and the aldehyde selectivity is low, though production of a high-

boiling component such as an acetal can be suppressed, so that the method is practically unsatisfactory.

In Patent Literature 3, a reaction using isobutylene as a raw material is also described, but it is not described to allow unreacted isobutylene to react with carbon monoxide and hydrogen again.

[0006] In the light of the above circumstances, an object of the present disclosure is to provide a method for producing, selectively and in a high yield, 3,5,5-trimethylhexanal that is useful as a raw material or the like of carboxylic acid or the like that becomes a raw material of a refrigerating machine oil, etc.

Solution to Problem

[0007] [1]

In an aspect, there is provided a method for producing 3,5,5-trimethylhexanal by allowing diisobutylene (DIB), carbon monoxide and hydrogen to react with one another in the presence of a cobalt-based catalyst, comprising:

a step of allowing DIB to react with carbon monoxide and hydrogen in the presence of a cobalt-based catalyst until a conversion of DIB reaches 50 to 85% (first stage reaction step);

a step of separating unreacted DIB from a reaction product obtained in the first stage reaction step (unreacted DIB separation step); and

a step of allowing the unreacted DIB separated to react with carbon monoxide and hydrogen in the presence of a cobalt-based catalyst (second stage reaction step).

[2]

The method for producing 3,5,5-trimethylhexanal according to the above [1], wherein in the second stage reaction step, a reaction temperature (°C) x and a cobalt concentration (g/kg) y based on DIB satisfy the following expressions (1) and (2):

(1) $y \leq 8.0 \times 10^{6} e^{-0.09x}$

(2) $0.1 \leq y \leq 20.$

[3]

The method for producing 3,5,5-trimethylhexanal according to the above [2], wherein in the second stage reaction step, the cobalt concentration (g/kg) y based on DIB satisfies the following expression (3):

(3) $0.1 \leq y \leq 15.$

[4]

The method for producing 3,5,5-trimethylhexanal according to any one of the above [1] to [3], wherein the reaction temperature in the second stage reaction step is 180°C or less.

[5]

In another aspect, there is provided a method for producing 3,5,5-trimethylhexanoic acid, comprising a step of oxidizing 3,5,5-trimethylhexanal obtained in the production method according to any one of the above [1] to [4].

[6]

In another aspect, there is provided a method for suppressing production of 3,5,5-trimethylhexanol, in a method for producing 3,5,5-trimethylhexanal by allowing diisobutylene (DIB), carbon monoxide and hydrogen to react with one another in the presence of a cobalt-based catalyst, comprising:

a step of allowing DIB to react with carbon monoxide and hydrogen in the presence of a cobalt-based catalyst until a conversion of DIB reaches 50 to 85% (first stage reaction step);

a step of separating unreacted DIB from a reaction product obtained in the first stage reaction step (unreacted DIB separation step); and

a step of allowing the unreacted DIB separated to react with carbon monoxide and hydrogen at 180°C or less in the presence of a cobalt-based catalyst (second stage reaction step).

[7]

In another aspect, there is provided a method for improving a production ratio of 3,5,5-trimethylhexanal to 3,5,5-trimethylhexanol (3,5,5-trimethylhexanal/3,5,5-trimethylhexanol), in a method for producing 3,5,5-trimethylhexanal by allowing diisobutylene (DIB), carbon monoxide and hydrogen to react with one another in the presence of a cobalt-based catalyst, comprising:

a step of allowing DIB to react with carbon monoxide and hydrogen in the presence of a cobalt-based catalyst

until a conversion of DIB reaches 50 to 85% (first stage reaction step);

a step of separating unreacted DIB from a reaction product obtained in the first stage reaction step (unreacted DIB separation step); and

a step of allowing the unreacted DIB separated to react with carbon monoxide and hydrogen at 180°C or less in the presence of a cobalt-based catalyst (second stage reaction step).

Advantageous Effect

[0008] By the present disclosure, a method for producing, selectively and in a high yield, 3,5,5-trimethylhexanal that is useful as a raw material or the like of carboxylic acid or the like that becomes a raw material of a refrigerating machine oil, etc. can be provided.

Brief Description of Drawing

[0009] [Figure 1] Figure 1 shows an example of a flow in the case where the production method of the present invention is carried out using an industrial continuous reaction apparatus.

Description of Embodiment

[0010] Hereinafter, an embodiment for carrying out the present invention (also referred to as "present embodiment" hereinafter) will be described in detail.