CLAIMS

[Claim 1] A cleaner for removing water-soluble, lead-free soldering flux, comprising a glycol ether compound (A) and water, the glycol ether compound (A) being contained in an amount of 5 to 100 parts by weight per 100 parts by weight of water.

[Claim 2] The cleaner for removing water-soluble, lead-free soldering flux according to claim 1, wherein the cleaner comprises 5 to 45 parts by weight of the glycol ether compound (A) per 100 parts by weight of water.

[Claim 3] The cleaner for removing water-soluble, lead-free soldering flux according to claim 1 or 2, which further comprises:

an amine compound (B) represented by Formula (1):

$$R^1-N\begin{matrix}-(CH_2CH_2O)_a-Y\\ |\\ (CH_2CH_2O)_b-Z\end{matrix} \qquad (1)$$

wherein R^1 is C_{1-7} alkyl or hydrogen, Y is C_{1-5} alkyl or hydrogen, Z is C_{1-5} alkyl or hydrogen, a is an integer of 1 to 5, and b is an integer of 0 to 5; and/or

a chelating agent having no amino group (C).

[Claim 4] The cleaner for removing water-soluble, lead-free soldering flux according to any one of claims 1 to 3,

wherein the glycol ether compound (A) is represented by Formula (2):

$$R^2O-(CH_2\underset{|}{\overset{R^3}{C}}HO)_c-R^4 \qquad (2)$$

wherein R^2 is C_{1-6} alkyl, R^3 is methyl or hydrogen, R^4 is C_{1-5} alkyl or hydrogen, and c is an integer of 1 to 4.

[Claim 5] The cleaner for removing water-soluble, lead-free soldering flux according to any one of claims 1 to 4, wherein the glycol ether compound (A) exhibits a property of completely dissolving in water under conditions of a liquid temperature of 20°C and a pressure of 100 kPa.

[Claim 6] The cleaner for removing water-soluble, lead-free soldering flux according to any one of claims 1 to 5, wherein the glycol ether compound (A) is at least one member selected from the group consisting of diethylene glycol monomethyl ether, triethylene glycol monomethyl ether, diethylene glycol monobutyl ether, triethylene glycol monobutyl ether, and dipropylene glycol monomethyl ether.

[Claim 7] The cleaner for removing water-soluble, lead-free soldering flux according to any one of claims 3 to 6, wherein the amine compound (B) is at least one member selected from the group consisting of N-methyldiethanolamine, N-ethyldiethanolamine, N-butyldiethanolamine, and N-propyldiethanolamine.

[Claim 8] The cleaner for removing water-soluble, lead-free soldering flux according to any one of claims 3 to 7, wherein the chelating agent having no amino group (C) is an aliphatic hydroxycarboxylic acid-based chelating agent and/or a (poly)phosphoric acid-based chelating agent.

[Claim 9] The cleaner for removing water-soluble, lead-free soldering flux according to claim 8, wherein the aliphatic hydroxycarboxylic acid-based chelating agent is at least one member selected from the group consisting of citric acid, isocitric acid, and malic acid.

[Claim 10] The cleaner for removing water-soluble, lead-free soldering flux according to claim 8, wherein the (poly)phosphoric acid-based chelating agent is at least one member selected from the group consisting of orthophosphoric acid, pyrophosphoric acid, and triphosphoric acid.

[Claim 11] The cleaner for removing water-soluble, lead-free soldering flux according any one of claims 3 to 10, wherein the cleaner comprises 0.1 to 10 parts by weight of the amine compound (B) and/or 0.04 to 4 parts by weight of the chelating agent having no amino group (C) per 100 parts by weight of water.

[Claim 12] The cleaner for removing water-soluble, lead-free soldering flux according to any one of claims 3 to 11, wherein the cleaner comprises the glycol ether compound (A), the amine compound (B), and the chelating agent having no amino group (C).

[Claim 13] A method for removing water-soluble, lead-free soldering flux, comprising

bringing the cleaner for removing water-soluble, lead-free soldering flux of any one of claims 1 to 12 into contact with water-soluble, lead-free soldering flux.

[Claim 14] A method for cleaning an object to be cleaned to which water-soluble, lead-free soldering flux is adhered, comprising:

a cleaning step comprising bringing the cleaner for removing water-soluble, lead-free soldering flux of any one of claims 1 to 12 into contact with an object to be cleaned to which water-soluble, lead-free soldering flux is adhered, so as to remove the water-soluble, lead-free soldering flux from the object; and

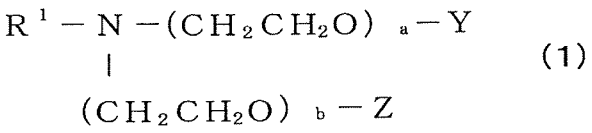
a water-rinsing step comprising roughly rinsing with water the object from which the water-soluble, lead-free soldering flux was removed, so as to clean off cleaner components adhering to the object.

CLAIMS

[Claim 1] A cleaner for removing water-soluble, lead-free soldering flux, comprising:

a glycol ether compound (A);

an amine compound (B) represented by Formula (1):



(1)

wherein R^1 is C_{1-7} alkyl or hydrogen, Y is C_{1-5} alkyl or hydrogen, Z is C_{1-5} alkyl or hydrogen, a is an integer of 1 to 5, and b is an integer of 0 to 5; and

water,

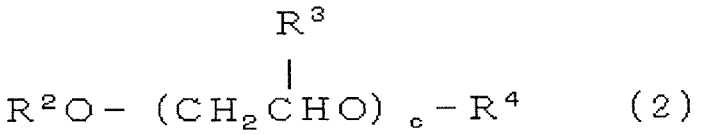
the glycol ether compound (A) being contained in an amount of 5 to 45 parts by weight per 100 parts by weight of water, the amine compound (B) being contained in an amount of 0.1 to 10 parts by weight per 100 parts by weight of water, and the cleaner being free from anionic surfactants.

[Claim 2] The cleaner for removing water-soluble, lead-free soldering flux according to claim 1, which further comprises:

a chelating agent having no amino group (C) in an amount of 0.04 to 4 parts by weight per 100 parts by weight of water.

[Claim 3] The cleaner for removing water-soluble, lead-free soldering flux according to claim 1,

wherein the glycol ether compound (A) is represented by Formula (2):



(2)

wherein R^2 is C_{1-6} alkyl, R^3 is methyl or hydrogen, R^4 is C_{1-5} alkyl or hydrogen, and c is an integer of 1 to 4.

[Claim 4] The cleaner for removing water-soluble, lead-free soldering flux according to claim 1, wherein the glycol ether compound (A) exhibits a property of completely dissolving in water under conditions of a liquid temperature of 20°C and a pressure of 100 kPa.

[Claim 5] The cleaner for removing water-soluble, lead-free soldering flux according to claim 1, wherein the glycol ether compound (A) is at least one member selected from the group consisting of diethylene glycol monomethyl ether, triethylene glycol monomethyl ether, diethylene glycol monobuthyl ether, triethylene glycol monobuthyl ether, and dipropylene glycol monomethyl ether.

[Claim 6] The cleaner for removing water-soluble, lead-free soldering flux according to claim 2, wherein the amine compound (B) is at least one member selected from the group consisting of N-methyldiethanolamine, N-ethyldiethanolamine, Nbuthyldiethanolamine, and N-propyldiethanolamine.

[Claim 7] The cleaner for removing water-soluble, lead-free soldering flux according to claim 2, wherein the chelating agent having no amino group (C) is an aliphatic hydrocarboxylic acid-based chelating agent and/or a (poly)phosphoric acid-based chelating agent.

[Claim 8] The cleaner for removing water-soluble, lead-free soldering flux according to claim 7, wherein the aliphatic hydrocarboxylic acid-based chelating agent is at least one member selected from the group consisting of citric acid, isocitric acid, and malic acid.

[Claim 9] The cleaner for removing water-soluble, lead-free soldering flux according to claim 7, wherein the (poly)phosphoric acid-based chelating agent is at least one member selected from the group consisting of orthophosphoric acid, pyrophosphoric acid, and triphosphoric acid.

[Claim 10] The cleaner for removing water-soluble, lead-free soldering flux according to claim 2, wherein the cleaner comprises the glycol ether compound (A), the amine compound (B), and the chelating agent having no amino group (C).

[Claim 11] A method for removing water-soluble, lead-free soldering flux, comprising

bringing the cleaner for removing water-soluble, lead-free soldering flux of claim 1 into contact with water-soluble, lead-free soldering flux.

[Claim 12] A method for cleaning an object to be cleaned to which water-soluble, lead-free soldering flux is adhered, comprising:

a cleaning step comprising bringing the cleaner for removing water-soluble, lead-free soldering flux of claim 1 into contact with an object to be cleaned to which water-soluble, lead-free soldering flux is adhered, so as to remove the water-soluble, lead-free soldering flux from the object; and

a water-rinsing step comprising roughly rinsing with water the object from which the water-soluble, lead-free soldering flux was removed, so as to clean off cleaner components adhering to the object.