

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MOTIF FOODWORKS, INC.,

Petitioner,

v.

IMPOSSIBLE FOODS INC.,
Patent Owner.

U.S. Patent No. 11,224,241

“METHODS AND COMPOSITIONS FOR
AFFECTING THE FLAVOR AND AROMA
PROFILE OF CONSUMABLES”

Inter Partes Review No. 2023-00207

**PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,224,241
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.100 *et seq.***

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Exhibit No.	Description
EX1158	U.S. Patent No. 11,013,250 to Vrljic et al.
EX1159	Reserved

LIST OF CHALLENGED CLAIMS

Claim 1	
Element No.	Claim Limitation
1[pre]	A meat-like-food product produced by a method comprising:
1[a]	providing one or more plant proteins; and
1[b]	combining, with the one or more plant proteins: a composition comprising a heme-containing protein, wherein the composition comprises at least 60% of the heme-containing protein on a dry weight basis;
1[c]	a compound selected from glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose, and mixtures of two or more thereof; and
1[d]	a compound selected from cysteine, cystine, thiamine, methionine, and mixtures of two or more thereof in a concentration of at least 1.5 mM;
1[e]	wherein the meat-like food product is free of animal heme-containing protein;
1[f]	wherein cooking the meat-like-food-product results in the production of at least two volatile compounds which have a meat-associated aroma; and
1[g]	wherein the meat-like food product is in a form selected from the group consisting of a hotdog, a burger, ground meat, a sausage, a steak, a filet, a roast, a meatball, a meatloaf, or bacon.
Claim 2	
2. The meat-like-food product of claim 1, wherein the one or more plant proteins comprise a textured vegetable protein.	
Claim 3	
3. The meat-like-food product of claim 2, wherein the textured vegetable protein is textured soy protein.	

Claim 4
4. The meat-like-food product of claim 1, wherein the composition comprising the heme-containing protein comprises at least 70% of the heme-containing protein on a dry weight basis.
Claim 5
5. The meat-like-food product of claim 1, wherein the composition comprising the heme-containing protein comprises at least 80% of the heme-containing protein on a dry weight basis.
Claim 6
6. The meat-like-food product of claim 1, wherein the heme-containing protein is a globin.
Claim 7
7. The meat-like-food product of claim 1, wherein the heme-containing protein comprises an amino acid sequence having at least 80% sequence identity to a polypeptide set forth in SEQ ID NOs. 1-26.
Claim 8
8. The meat-like-food product of claim 1, wherein the cysteine is added to a concentration of about 0.8 mM to about 10 mM.
Claim 9
9. The meat-like-food product of claim 1, wherein the thiamine is added to a concentration of about 0.1 mM to about 2 mM.
Claim 10
10. The meat-like-food product of claim 1, further comprising combining, with the one or more plant proteins, one or more of inosine, inosine monophosphate (IMP), guanosine, guanosine monophosphate (GMP), and adenosine monophosphate (AMP).
Claim 11

11. The meat-like-food product of claim 1, further comprising combining with the one more plant proteins, one or more of beta-carotene, alpha-tocopherol, caffeic acid, propyl gallate, and epigallocatechin gallate.
Claim 12
12. The meat-like-food product of claim 1, further comprising combining with the one more plant proteins, one or more of a vegetable oil, an algal oil, sunflower oil, corn oil, soybean oil, palm fruit oil, palm kernel oil, safflower oil, flaxseed oil, rice bran oil, cottonseed oil, olive oil, canola oil, flaxseed oil, coconut oil, and mango oil.
Claim 13
13. The meat-like-food product of claim 1, further comprising combining with the one more plant proteins, one or more of acetic acid, lactic acid, glycolic acid, citric acid, succinic acid, tartaric acid, caprylic acid, capric acid, lauric acid, myristic acid, palmitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid, alpha linolenic acid, gamma linolenic acid, arachidic acid, arachidonic acid, behenic acid, and erucic acid.
Claim 14
14. The meat-like-food product of claim 1, wherein cooking comprises heating the meat-like food product at 150° C. for about 3 to about 5 minutes.
Claim 15
15. The meat-like-food product of claim 1, wherein the meat-like food product has a pink to red color before cooking to indicate a raw or uncooked state.
Claim 16
16. The meat-like-food product of claim 1, wherein at least a portion of the meat-like food product, upon cooking, transitions in color from a pink to red color in a raw or uncooked state to a lighter pink to brown color in a partially cooked to fully cooked state.
Claim 17
17. The meat-like-food product of claim 1, wherein cooking the meat-like-food product results in the production of at least five volatile compounds selected

from the group consisting of (1-ethyl-1-propenyl)-benzene, (E)-2-decenal, (E)-2-heptenal, (E)-2-hexenal, (E)-2-nonenal, (E)-2-octen-1-ol, (E)-2-octenal, (E)-2-tridecen-1-ol, (E)-3-penten-2-one, (E)-4-octene, (E)-5-decene, (E,E)-3,5-octadien-2-one, (Z)-2-decenal, (Z)-2-heptenal, (Z)-3-decen-1-ol, acetate, [(methylsulfonyl)methyl]-benzene, 1-(ethylthio)-2-(methylthio)-buta-1,3-diene, 1-(methylthio)-propane, 1,1'-(1,2-cyclobutanediyl)bis-cis-benzene, 1,10-undecadiene, 1,3,5-cycloheptatriene, 1,3-bis(1,1-dimethylethyl)-benzene, 1,3-diisopropoxy-1,3-dimethyl-1,3-disilacyclobutane, 1,3-dimethyl-benzene, 1-decen-3-one, 1-heptanol, 1-heptyl-1,2,3,4-tetrahydro-4-methyl-naphthalene, 1-hexanol, 1-hydroxy-2-propanone, 1-nonanol, 1-octanol, 1-octen-3-ol, 1-octen-3-one, 1-octene, 1-pentanol, 1-penten-3-one, 1-undecanol, 2,2,4,6,6-pentamethyl-heptane, 2,3,4-trimethyl-pentane, 2,3-butanedione, 2,3-dihydro-5-methyl-furan, 2,3-dimethyl-pyrazine, 2,4-decadienal, 2,4-dimethyl-1-heptene, 2,5-dimethyl-pyrazine, 2-acetetyl-1-propene, 2-acetyl-propen-2-ol, 2-acetylthiazole, 2-butanone, 2-butenal, 2-butyl-1-decene, 2-decanone, 2-decenal, 2-ethyl-5-methyl-pyrazine, 2-ethylacrolein, 2-ethyl-furan, 2-heptanone, 2-heptenal, 2-hexyl furan, 2-methyl-1(H)-pyrrole, 2-methyl-1-heptene, 2-methyl-1-penten-1-one, 2-methyl-3-(methylthio) furan, 2-methyl-3-furanthiol, 2-methyl-5-(methylthio)-furan, 2-methyl-butanal, 2-methyl-cyclopentanone, 2-methyl-furan, 2-methyl-heptane, 2-methyl-pentanal, 2-methyl-propanal, 2-methyl-thiazole, 2-n-octylfuran, 2-nonanone, 2-nonen-4-one, 2-octanone, 2-octenal, 2-pentanone, 2-pentyl-furan, 2-pentyl-thiophene, 2-phenylpropenal, 2-propenal, 2-propenoic acid, methyl ester, 2-thiophenecarboxaldehyde, 2-tridecen-1-ol, 2-undecanone, 2-undecenal, 3-(methylthio)-propanenitrile, 3-(phenylmethyl)-2,5-piperazinedione, 3,3'-dithiobis-2-methyl-furan, 3,5-bis(1,1-dimethylethyl)-phenol, 3,5-di-tert-butylbenzoic acid, 3-decen-2-one, 3-ethylcyclopentanone, 3-ethyl-pentane, 3-methyl-2-butenal, 3-methyl-2-thiophenecarboxaldehyde, 3-methyl-3-buten-2-one, 3-methyl-butanal, 3-methyl-furan, 3-methylheptyl acetate, 3-methyl-pentanal, 3-pentyl-furan, 3-phenyl-furan, 3-thiophenecarboxaldehyde, 3-thiophenemethanol, 4,7-dimethyl-undecane, 4-chloro-2,6-bis(1,1-dimethylethyl)-phenol, 4-ethoxy-benzoic acid, ethyl ester, 4-ethyl-2-methyl-pyrrole, 4-ethyl-benzaldehyde, 4-methyl-2-heptanone, 4-methyl-5-thiazoleethanol, 4-methylthiazole, 4-nitrophenyl 2-thiophenecarboxylic acid ester, 4-penten-2-one, 4-quinolinecarboxaldehyde, 5-(2-chloroethyl)-4-methylthiazole, 5-ethenyl-4-methyl-thiazole, 5-ethyldihydro-2(3H)-furanone, 5-formyl-4-methylthiazole, 5-methyl-1-undecene, 6-methyl-2-heptanone, 7-methyl-(E)-5-undecene, 9-octadecenal, acetaldehyde, acetic acid, acetone, acetonitrile, acetophenone, acetyl valeryl, aminophenylacetylene, benzaldehyde, benzene, benzoic acid, benzyl alcohol, bis(2-methyl-4,5-dihydro-3-furyl) disulfide, butanal, butanone, butyrolactone, carbon disulfide, decanal, dihydro-3-(2H)-thiophenone, dihydro-

5-pentyl-2(3H)-furanone, dimethyl selenone, dimethyl sulfide, dimethyl trisulfide, dodecanal, ethanol, ethyl acetate, formic acid, heptyl ester, furan, furfural, heptanal, hexanoic acid, isopropyl alcohol, isothiazole, isothiocyanatomethane, m-aminophenylacetylene, methacrolein, methanethiol, methional, methyl (methylthio)methyl disulfide, methyl isopropyl disulphide, methyl thiolacetate, methyl vinyl ketone, methyl-pyrazine, methyl-thiirane, nonanal, octanal, octane, oxalic acid, diallyl ester, oxalic acid, isobutyl pentyl ester, p-cresol, p-dithiane-2,5-diol, pentanal, pentanoic acid, 2,2,4-trimethyl-3-hydroxy-, isobutyl ester, phenol, phenylacetaldehyde, propanal, propyl-cyclopropane, p-xylene, pyrazine, pyrrole, styrene, thiazole, thiocyanic acid, methyl ester, thiophene, toluene, trans-2-(2-pentenyl)furan, and tridecane.

Claim 18

18. The meat-like food product of claim 1, wherein cooking the meat-like food product results in the production of at least ten volatile compounds selected from the group consisting of (1-ethyl-1-propenyl)-benzene, (E)-2-decenal, (E)-2-heptenal, (E)-2-hexenal, (E)-2-nonenal, (E)-2-octen-1-ol, (E)-2-octenal, (E)-2-tridecen-1-ol, (E)-3-penten-2-one, (E)-4-octene, (E)-5-decene, (E,E)-3,5-octadien-2-one, (Z)-2-decenal, (Z)-2-heptenal, (Z)-3-decen-1-ol, acetate, [(methylsulfonyl)methyl]-benzene, 1-(ethylthio)-2-(methylthio)-buta-1,3-diene, 1-(methylthio)-propane, 1,1'-(1,2-cyclobutanediyl)bis-cis-benzene, 1,10-undecadiene, 1,3,5-cycloheptatriene, 1,3-bis(1,1-dimethylethyl)-benzene, 1,3-diisopropoxy-1,3-dimethyl-1,3-disilacyclobutane, 1,3-dimethyl-benzene, 1-decen-3-one, 1-heptanol, 1-heptyl-1,2,3,4-tetrahydro-4-methyl-naphthalene, 1-hexanol, 1-hydroxy-2-propanone, 1-nonanol, 1-octanol, 1-octen-3-ol, 1-octen-3-one, 1-octene, 1-pentanol, 1-penten-3-one, 1-undecanol, 2,2,4,6,6-pentamethylheptane, 2,3,4-trimethyl-pentane, 2,3-butanedione, 2,3-dihydro-5-methyl-furan, 2,3-dimethyl-pyrazine, 2,4-decadienal, 2,4-dimethyl-1-heptene, 2,5-dimethylpyrazine, 2-acetetyl-1-propene, 2-acetyl-propen-2-ol, 2-acetylthiazole, 2-butanone, 2-butenal, 2-butyl-1-decene, 2-decanone, 2-decenal, 2-ethyl-5-methylpyrazine, 2-ethylacrolein, 2-ethyl-furan, 2-heptanone, 2-heptenal, 2-hexyl furan, 2-methyl-1(H)-pyrrole, 2-methyl-1-heptene, 2-methyl-1-penten-1-one, 2-methyl-3-(methylthio) furan, 2-methyl-3-furanthiol, 2-methyl-5-(methylthio)-furan, 2-methyl-butanal, 2-methyl-cyclopentanone, 2-methyl-furan, 2-methyl-heptane, 2-methyl-pentanal, 2-methyl-propanal, 2-methyl-thiazole, 2-n-octylfuran, 2-nonanone, 2-nonen-4-one, 2-octanone, 2-octenal, 2-pentanone, 2-pentyl-furan, 2-pentyl-thiophene, 2-phenylpropenal, 2-propenal, 2-propenoic acid, methyl ester, 2-thiophenecarboxaldehyde, 2-tridecen-1-ol, 2-undecanone, 2-undecenal, 3-(methylthio)-propanenitrile, 3-(phenylmethyl)-2,5-piperazinedione, 3,3'-

dithiobis-2-methyl-furan, 3,5-bis(1,1-dimethylethyl)-phenol, 3,5-di-tert-butylbenzoic acid, 3-decen-2-one, 3-ethylcyclopentanone, 3-ethyl-pentane, 3-methyl-2-butenal, 3-methyl-2-thiophenecarboxaldehyde, 3-methyl-3-buten-2-one, 3-methyl-butanal, 3-methyl-furan, 3-methylheptyl acetate, 3-methyl-pentanal, 3-pentyl-furan, 3-phenyl-furan, 3-thiophenecarboxaldehyde, 3-thiophenemethanol, 4,7-dimethyl-undecane, 4-chloro-2,6-bis(1,1-dimethylethyl)-phenol, 4-ethoxy-benzoic acid, ethyl ester, 4-ethyl-2-methyl-pyrrole, 4-ethyl-benzaldehyde, 4-methyl-2-heptanone, 4-methyl-5-thiazoleethanol, 4-methylthiazole, 4-nitrophenyl 2-thiophenecarboxylic acid ester, 4-penten-2-one, 4-quinolinecarboxaldehyde, 5-(2-chloroethyl)-4-methylthiazole, 5-ethenyl-4-methyl-thiazole, 5-ethyl-dihydro-2(3H)-furanone, 5-formyl-4-methylthiazole, 5-methyl-1-undecene, 6-methyl-2-heptanone, 7-methyl-(E)-5-undecene, 9-octadecenal, acetaldehyde, acetic acid, acetone, acetonitrile, acetophenone, acetyl valeryl, aminophenylacetylene, benzaldehyde, benzene, benzoic acid, benzyl alcohol, bis(2-methyl-4,5-dihydro-3-furyl) disulfide, butanal, butanone, butyrolactone, carbon disulfide, decanal, dihydro-3-(2H)-thiophenone, dihydro-5-pentyl-2(3H)-furanone, dimethyl selenone, dimethyl sulfide, dimethyl trisulfide, dodecanal, ethanol, ethyl acetate, formic acid, heptyl ester, furan, furfural, heptanal, hexanoic acid, isopropyl alcohol, isothiazole, isothiocyanatomethane, m-aminophenylacetylene, methacrolein, methanethiol, methional, methyl (methylthio)methyl disulfide, methyl isopropyl disulphide, methyl thiolacetate, methyl vinyl ketone, methyl-pyrazine, methyl-thiirane, nonanal, octanal, octane, oxalic acid, diallyl ester, oxalic acid, isobutyl pentyl ester, p-cresol, p-dithiane-2,5-diol, pentanal, pentanoic acid, 2,2,4-trimethyl-3-hydroxy-, isobutyl ester, phenol, phenylacetaldehyde, propanal, propyl-cyclopropane, p-xylene, pyrazine, pyrrole, styrene, thiazole, thiocyanic acid, methyl ester, thiophene, toluene, trans-2-(2-pentenyl)furan, and tridecane.

Claim 19

19. The meat-like-food product of claim 1, wherein cooking the meat-like-food product results in the production of at least twenty volatile compounds selected from the group consisting of (1-ethyl-1-propenyl)-benzene, (E)-2-decenal, (E)-2-heptenal, (E)-2-hexenal, (E)-2-nonenal, (E)-2-octen-1-ol, (E)-2-octenal, (E)-2-tridecen-1-ol, (E)-3-penten-2-one, (E)-4-octene, (E)-5-decene, (E,E)-3,5-octadien-2-one, (Z)-2-decenal, (Z)-2-heptenal, (Z)-3-decen-1-ol, acetate, [(methylsulfonyl)methyl]-benzene, 1-(ethylthio)-2-(methylthio)-buta-1,3-diene, 1-(methylthio)-propane, 1,1'-(1,2-cyclobutanediyl)bis-cis-benzene, 1,10-undecadiene, 1,3,5-cycloheptatriene, 1,3-bis(1,1-dimethylethyl)-benzene, 1,3-diisopropoxy-1,3-dimethyl-1,3-disilacyclobutane, 1,3-dimethyl-benzene, 1-

decen-3-one, 1-heptanol, 1-heptyl-1,2,3,4-tetrahydro-4-methyl-naphthalene, 1-hexanol, 1-hydroxy-2-propanone, 1-nonanol, 1-octanol, 1-octen-3-ol, 1-octen-3-one, 1-octene, 1-pentanol, 1-penten-3-one, 1-undecanol, 2,2,4,6,6-pentamethylheptane, 2,3,4-trimethyl-pentane, 2,3-butanedione, 2,3-dihydro-5-methyl-furan, 2,3-dimethyl-pyrazine, 2,4-decadienal, 2,4-dimethyl-1-heptene, 2,5-dimethyl-pyrazine, 2-acetetyl-1-propene, 2-acetyl-propen-2-ol, 2-acetylthiazole, 2-butanone, 2-butenal, 2-butyl-1-decene, 2-decanone, 2-decenal, 2-ethyl-5-methyl-pyrazine, 2-ethylacrolein, 2-ethyl-furan, 2-heptanone, 2-heptenal, 2-hexyl furan, 2-methyl-1(H)-pyrrole, 2-methyl-1-heptene, 2-methyl-1-penten-1-one, 2-methyl-3-(methylthio) furan, 2-methyl-3-furanthiol, 2-methyl-5-(methylthio)-furan, 2-methyl-butanal, 2-methyl-cyclopentanone, 2-methyl-furan, 2-methyl-heptane, 2-methyl-pentanal, 2-methyl-propanal, 2-methyl-thiazole, 2-n-octylfuran, 2-nonanone, 2-nonen-4-one, 2-octanone, 2-octenal, 2-pentanone, 2-pentyl-furan, 2-pentyl-thiophene, 2-phenylpropenal, 2-propenal, 2-propenoic acid, methyl ester, 2-thiophenecarboxaldehyde, 2-tridecen-1-ol, 2-undecanone, 2-undecenal, 3-(methylthio)-propanenitrile, 3-(phenylmethyl)-2,5-piperazinedione, 3,3'-dithiobis-2-methyl-furan, 3,5-bis(1,1-dimethylethyl)-phenol, 3,5-di-tert-butylbenzoic acid, 3-decen-2-one, 3-ethylcyclopentanone, 3-ethyl-pentane, 3-methyl-2-butenal, 3-methyl-2-thiophenecarboxaldehyde, 3-methyl-3-buten-2-one, 3-methyl-butanal, 3-methyl-furan, 3-methylheptyl acetate, 3-methyl-pentanal, 3-pentyl-furan, 3-phenyl-furan, 3-thiophenecarboxaldehyde, 3-thiophenemethanol, 4,7-dimethyl-undecane, 4-chloro-2,6-bis(1,1-dimethylethyl)-phenol, 4-ethoxy-benzoic acid, ethyl ester, 4-ethyl-2-methyl-pyrrole, 4-ethyl-benzaldehyde, 4-methyl-2-heptanone, 4-methyl-5-thiazoleethanol, 4-methylthiazole, 4-nitrophenyl 2-thiophenecarboxylic acid ester, 4-penten-2-one, 4-quinolinecarboxaldehyde, 5-(2-chloroethyl)-4-methylthiazole, 5-ethenyl-4-methyl-thiazole, 5-ethyldihydro-2(3H)-furanone, 5-formyl-4-methylthiazole, 5-methyl-1-undecene, 6-methyl-2-heptanone, 7-methyl-(E)-5-undecene, 9-octadecenal, acetaldehyde, acetic acid, acetone, acetonitrile, acetophenone, acetyl valeryl, aminophenylacetylene, benzaldehyde, benzene, benzoic acid, benzyl alcohol, bis(2-methyl-4,5-dihydro-3-furyl) disulfide, butanal, butanone, butyrolactone, carbon disulfide, decanal, dihydro-3-(2H)-thiophenone, dihydro-5-pentyl-2(3H)-furanone, dimethyl selenone, dimethyl sulfide, dimethyl trisulfide, dodecanal, ethanol, ethyl acetate, formic acid, heptyl ester, furan, furfural, heptanal, hexanoic acid, isopropyl alcohol, isothiazole, isothiocyanatomethane, m-aminophenylacetylene, methacrolein, methanethiol, methional, methyl (methylthio)methyl disulfide, methyl isopropyl disulphide, methyl thiolacetate, methyl vinyl ketone, methyl-pyrazine, methyl-thiirane, nonanal, octanal, octane, oxalic acid, diallyl ester, oxalic acid, isobutyl pentyl ester, p-cresol, p-dithiane-2,5-diol, pentanal, pentanoic acid, 2,2,4-trimethyl-3-hydroxy-,

isobutyl ester, phenol, phenylacetaldehyde, propanal, propyl-cyclopropane, p-xylene, pyrazine, pyrrole, styrene, thiazole, thiocyanic acid, methyl ester, thiophene, toluene, trans-2-(2-pentenyl)furan, and tridecane.	
Claim 20	
20. The meat-like-food product of claim 1, wherein the at least two volatile compounds are selected from 2-methyl-furan, bis(2-methyl-3-furyl)disulfide, 2-pentyl-furan, 3,3'-dithiobis-2-methyl-furan, 2,5-dimethyl-pyrazine, 2-methyl-3-furanthiol, dihydro-3-(2H)-thiophenone, 5-methyl-2-thiophenecarboxaldehyde, 3-methyl-2-thiophenecarboxaldehyde, 2-methyl-thiazole, dimethyl sulfide, decanal, 5-ethyl-dihydro-2(3H)-furanone, dihydro-5-pentyl-2(3H)-furanone, 2-octanone, 3,5-octadien-2-one, p Cresol, p cresol, and hexanoic acid.	
Claim 21	
21. The meat-like-food product of claim 1, wherein the at least two volatile compounds are 2-methyl-furan and bis(2-methyl-3-furyl)disulfide.	
Claim 22	
22[pre]	A meat-like-food product produced by a method comprising:
22[a]	providing one or more plant proteins; and
22[b]	combining, with the one or more plant proteins: a heme-containing protein;
22[c]	one or more of glucose, ribose, fructose, lactose, xylose, arabinose, glucose-6-phosphate, maltose, and galactose; and
22[d]	one or more of cysteine, cystine, thiamine, and methionine;
22[e]	wherein the meat-like food product is free of animal heme-containing protein;
22[f]	wherein cooking the meat-like-food-product results in the production of at least two volatile compounds which have a meat-associated aroma; and

22[g]	wherein the meat-like food product is in a form selected from the group consisting of a hotdog, a burger, ground meat, a sausage, a steak, a filet, a roast, a meatball, a meatloaf, or bacon.
Claim 23	
23. The meat-like food product of claim 22, wherein the meat-like food product is free of animal products.	

I. INTRODUCTION

Motif FoodWorks, Inc. (“Petitioner”) respectfully requests *inter partes* review of claims 1-23 (“Challenged Claims”) of U.S. Patent No. 11,224,241 (“’241 patent”) assigned to Impossible Foods Inc. (“Patent Owner” or “PO”).

II. STATE OF THE ART

A. Meat Flavor Chemistry

Researchers have long recognized that the aroma of meat, such as beef, is associated with thousands of volatile chemical compounds. EX1005(McGorin), ¶¶27-42. To create the compounds that produce meat flavor/aroma, “flavor precursors” may be chemically reacted using heat. *Id.*, ¶¶48-53. Precursors including sulfur compounds, such as cysteine or thiamine, and reducing sugars, such as glucose or ribose, are known to produce meaty flavors/aromas. *See id.*

The Maillard reaction with these precursor compounds is responsible for the distinctive flavor/aroma of foods. *Id.*, ¶¶46-47, 54-71.

B. Simulated Meat Flavoring Compositions

Enhanced meaty flavors/aromas from heme iron were well-known. *Id.*, ¶¶80-81. Conrad discloses that “[t]he addition of blood/hemoglobin further gives a desired taste improvement as it **improves the meat flavour** of the final product.” EX1013(Conrad), 4:14-16.¹ Yamaguchi also teaches that heme iron can improve the

¹ Emphasis added unless otherwise noted.

taste of foods, such as pork dumplings. EX1022(Yamaguchi), [0023], [0027], [0033]. “Brown” also touts that adding leghemoglobin to a flavor composition enhances the meat-like aroma. EX1012(Brown), [00364]; EX1005(McGorin), ¶¶80-81.

C. Benefits of Meat Substitutes

Despite the popularity of meat, many consumers avoid meat for ethical, environmental, health, personal, and/or religious reasons. Some believe that meat is unhealthy due to saturated fat and cholesterol. Others are concerned with environmental impacts of animal husbandry, including land and water needed to raise animals and produce feed. Others believe that meat is harmful to animal welfare. EX1003(Tarte), ¶¶58-63.

D. Recombinant Technology

Using recombinant technologies to engineer proteins for use in food products was well-known. EX1007(Batt), ¶¶40-49. Heme-containing irons, such as hemoglobin and leghemoglobin, could be produced using recombinant technology. *Id.*, ¶¶28-33.

III. THE '241 PATENT

A. Background

The '241 patent's claims are directed to methods for preparing meat-like-food products. EX1003(Tarte), ¶¶38-39. The '241 patent laments that “[c]urrent plant-based meat substitutes have largely failed to cause a shift to a vegetarian diet”

because these substitutes “fail to replicate the **aromas, flavors**, and other key features, such as texture and mouth-feel, associated with cooking or cooked meat.” EX1001, 1:50-60. The ’241 patent describes combining a “heme-containing protein” with “one or more flavor precursor molecules” to “provide a range of savory and meaty aromas and tastes...in a cooked consumable food product.” *Id.*, 2:48-55.

B. Prosecution History

The ’241 patent issued from U.S. Application No. 15/913,090 (“’090 application”), filed on March 6, 2018. The initial claims did not include the limitation that the meat-like-food product is “free of animal heme-containing protein.” EX1150, 442-446. The examiner rejected the presented claims as obvious over art that used real beef. *Id.*, 1122-1125 (citing “Hsieh,” “Proulx,” “Dinh”). PO amended its claims to require that the “food product [be] free of animal heme-containing protein.” *Id.*, 1249, 1258. Following the amendment, the examiner allowed the claims because the Hsieh meat-based reference did not disclose an animal-free product. *Id.*, 1269-1271. *See* EX1003(Tarte), ¶¶40-55.

C. Person of Ordinary Skill in the Art

The ’241 patent is directed to the art of food science and recombinant protein expression. A POSITA would have (i) a B.S. degree in food sciences, biology, chemistry, microbiology, or a related discipline, and (ii) a Master’s degree or Ph.D. in food science or at least three years of experience working as a food scientist. A

POSITA could also be part of a team of food scientists, including flavor chemists. EX1003(Tarte), ¶37; EX1005(McGorin), ¶¶82-83; EX1007(Batt), Section IV.A.

IV. PRIORITY DATE

The '241 patent's earliest priority claim is to U.S. Provisional No. 61/751,816 (the "'816 Provisional"), filed January 11, 2013. EX1025. The Challenged Claims are not entitled to the '816 Provisional's date because it fails to describe the full scope of the issued claims. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). The next earliest priority date for the '241 patent is July 12, 2013, which would make the '241 patent subject to AIA provisions.²

The '816 Provisional must reasonably convey that the named inventors "had possession of" the claimed subject matter. This "requires an objective inquiry into the four corners of the specification from the perspective of" a POSITA. *D Three Enterprises, LLC v. SunModo Corp.*, 890 F.3d 1042, 1047 (Fed. Cir. 2018). Adequate written description "requires a precise definition" of the invention. *Id.* "It is not sufficient...that the disclosure, when combined with the knowledge in the art, would lead one to speculate as to the modifications that the inventor might have envisioned, but failed to disclose." *Id.* at 1050.

² Application No. 13/941,211 (filed July 12, 2013) also fails to provide support for the Challenged Claims for the same reasons. However, Brown is prior art regardless.

Because the specification itself must demonstrate possession, a description that merely renders the claimed invention obvious does not show possession of the invention. *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010) (*en banc*)). The '816 Provisional fails to meet these standards.

First, the '816 Provisional does not disclose the claimed glucose-6-phosphate, cystine, thiamine, or methionine. *See, e.g.*, EX1025('816 Provisional), [00124], [00217], [00254]-[00255].³ Nor does it describe combining these compounds with a heme-containing protein to achieve a meat-associated aroma. EX1005(McGorin), ¶¶94-96.

Each of these compounds has a unique chemical structure different from the compounds disclosed in the '816 provisional. Chemical structure is significant because it affects the compounds' chemical reactivity. *Id.*, ¶¶94-98.

Second, the '816 Provisional does not disclose that a mixture of the claimed sugar and sulfur compounds, along with a heme-containing protein, would “result in the production of at least two volatile compounds which have a meat-associated aroma” upon cooking, as claimed. Rather, the '816 Provisional's disclosure of adding heme protein into a food product is general, and made almost entirely without

³ The '241 patent also claims priority to U.S. provisional app. no. 61/908,634, filed Nov. 25, 2013. Unlike the '816 Provisional, the later-filed '634 Provisional *does* expressly disclose glucose-6-phosphate, cystine, thiamine, and methionine. EX1145('634 Provisional), 9-10 (Table 1).

reference to combinations with specific sugar or sulfur compounds. See, e.g., EX1025('816 Provisional), [0023], [0032], [00217], [00288], [00290]. In fact, only a single paragraph in the entire disclosure describes reacting heme-containing proteins (identified in Table 1) with specific compounds, and that disclosure is limited to cysteine and glucose, and does not describe producing a “meaty aroma.” Id., [00255]; EX1005(McGorin), ¶¶98-103. The '816 Provisional never discloses combining heme-containing proteins with (1) any sugars except glucose or (2) any sulfur compounds except cysteine.⁴ A POSITA would understand that the claimed compounds produce different aroma and flavor profiles from those disclosed in the '816 Provisional. A POSITA would understand that the claimed sugar and sulfur compounds will chemically react differently in the Maillard reaction upon cooking, and that the volatile products depend on various factors such as temperature, pH, and the structural diversity of the precursor molecules that react to form volatiles. EX1005(McGorin), ¶¶104-105.

This lack of disclosure is not remedied by the '816 Provisional's list of potential classes of components of the meat-like-food product, including “amino acids, fats, peptides, nucleotides, organic acids, sulfur compounds, sugars and other

⁴ “Possession of the invention at the time of filing is best shown by *a precise description* in the text of the patent specification of *all* of the aspects of the claimed invention.” *Union Oil of Cal. v. Atlantic Richfield*, 208 F.3d 989, 1003 (Fed. Cir. 2000).

carbohydrates,” that allegedly produce “the characteristic flavor and fragrance components” of meat. EX1025(’816 Provisional), [00254]; see also *id.*, [00217]. These passages fail to adequately describe the claimed sugar and sulfur compounds because generalized references to “sugars” and “sulfur compounds” do not inform a POSITA that the named inventors were in possession of the full scope of the specific claimed sugar and sulfur compounds.⁵ EX1005(McGorin), ¶¶101-06, 112.

The purpose of the written description requirement is to prevent an applicant from later asserting they invented something that they did not. *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1330 (Fed. Cir. 2003). An applicant cannot disclose a laundry list of classes of compounds in the hopes to pick and choose specific compounds to craft their claimed invention. The specification must include “blaze marks” that direct a skilled artisan to the claimed invention. The ’816 Provisional fails to do so. EX1005(McGorin), ¶112.

Third, the ’816 Provisional does not disclose the claimed combination of a genus of heme proteins, sugars, and sulfur compounds, ***free of animal heme-***

⁵ Boilerplate language in a provisional that the invention should be “interpreted to include all such modifications, permutations, additions and sub-combinations” is “not sufficient to show adequate disclosure of the actual combinations and attachments used in the” claims. *D Three*, 890 F.3d at 1050; see also *Application of Ruschig*, 379 F.2d 990, 994 (C.C.P.A. 1967) (“Specific claims to single compounds require reasonably specific supporting disclosure.”).

containing protein, in the context of a meat-like-food product. The '816 Provisional discloses adding leghemoglobin and myoglobin to a “poultry composition” comprising real chicken and beef aroma. EX1025('816 Provisional), [0044], [00256], [00407]-[00408]. This does not show the named inventors were in possession of a meat-like-food product “free of animal heme-containing protein” by adding **any** combination of heme-containing protein, sugars, and sulfur compounds. EX1005(McGorin), ¶¶107-109.

Accordingly, the '241 patent is not entitled to the priority date of the '816 Provisional.

V. CLAIM CONSTRUCTION

A. “free of animal heme-containing protein”

The claimed meat-like-food product must be “free of animal heme-containing protein.” This limitation need not be construed for purposes of this proceeding. EX1003(Tarte), ¶¶111-112.

However, in parallel litigation, PO asserts that “free of animal heme-containing protein” covers bovine myoglobin, which is native to an animal (*Bos taurus* (cow)), even when produced in yeast (a non-animal **source**). See EX1009(SAC), ¶¶32, 140. Based on PO's interpretation, Grounds 2A-2D map “heme-containing protein” to recombinant bovine hemoglobin. EX1003(Tarte),

¶¶113-115.⁶

B. Process Limitations

“In determining validity of a product-by-process claim, the focus is on the product and not the process of making it. That is because of the...longstanding rule that an old product is not patentable even if it is made by a new process.” *Kamstrup A/S v. Axioma Metering UAB*, 43 F.4th 1374, 1381 (Fed. Cir. 2022) (citation omitted).⁷ However, “if the process by which a product is made imparts ‘structural and functional differences,’ distinguishing the claimed product from the prior art, then those differences” may be relevant to anticipation or obviousness. *Id.* Intrinsic and extrinsic evidence may enlighten whether such structural and functional differences exist. *Id.*; *Purdue Pharma L.P. v. Epic Pharma, LLC*, 811 F.3d 1345, 1353–54 (Fed. Cir. 2016) (disregarding process limitation where specification and expert testimony evidenced that process “imparts no structural or functional differences...as compared to the prior art products”).

Claim 1 and 22 recite a meat-like-food product ***produced by a method*** comprising, ***providing*** and ***combining*** plant protein(s) with certain additional “compositions/compounds.” EX1001, 77:53-78:59. These are process limitations.

⁶ If PO’s interpretation is not adopted, Grounds 2A-2D alternatively map “heme-containing protein” to ***leghemoglobin***, a heme-containing protein native to plants.

⁷ By contrast, a product-by-process claim is only ***infringed*** by a product made by the claimed process. *Abbott Laboratories v. Sandoz, Inc.*, 566 F.3d 1282, 1293 (Fed. Cir. 2009).

The pertinent question is whether these process limitations impart “structural and functional differences” to the claimed meat-like-food product. Like the product-by-process claims at issue in *Kamstrup* and *Purdue*, the intrinsic record and expert testimony demonstrate that the process elements do not. EX1003(Tarte), ¶¶116-132.

First, the claims do not recite any structural or functional differences imparted by the process limitations. The product made by the process is simply a “meat-like-food product” that is “free of animal heme-containing proteins” (limitation 1[e], 22[e]), that produces certain “meat-associated” volatile compounds when cooked (limitation 1[f], 22[f]), and that comes in a specific form (e.g., ground meat) (limitation 1[g], 22[g]). EX1003(Tarte), ¶120. Moreover, the patent specification only generically discloses that different flavor/aroma profiles may result from combining heme-containing protein with flavor precursors (e.g., sugars and sulfur-containing compounds) by “modulating” factors such as the type and amount of the heme-containing protein and flavor precursors, pH, water, cooking time and temperature. *See, e.g.*, EX1001, 12:59-13:6; EX1003(Tarte), ¶121.

Second, the language of the claims does not require any specific amount or proportion of the plant protein(s) and additional “compositions/compounds” used to produce the meat-like-food **product**. EX1001, 77:53-78:58, 83:9-27; EX1003(Tarte), ¶¶122-123. Neither the claims nor specification recite any difference imparted to the product by the concentration of any process ingredient.

See, e.g., EX1001, 12:39-13:6, 15:46-17:6; EX1003(Tarte), ¶¶124-131. And a POSITA would understand that the concentrations of ingredients in the final meat-like-food product would necessarily be different than the concentrations within the compositions/compounds of the process limitations before they are combined. EX1003(Tarte), ¶¶132. Thus, at least the dry weight percentage/concentration limitations of claims 1, 4-5 and 8-9 do not impart any structural or functional differences.

Third, the experiments and accompanying affidavits PO submitted during prosecution in support of purportedly “surprising” or “unexpected” results from the combination of a heme protein (leghemoglobin) with select Maillard precursor molecules (ribose and cysteine) compared to the same reaction conditions without the heme protein are meritless. EX1150, 121-124. Expert testimony shows that these ingredients, which are different than the claims, do not produce novel or increased meat-associated aromas, much less impart any structural or functional difference to meat-like-food products. *See* §XI.A-B; EX1005(McGorin), Section VIII.

Fourth, according to the PO, the difference that distinguishes the claimed “meat-like food product” from the prior art is not a structural or functional characteristic imparted by the process limitations. Rather, it is that the claimed product is “free of animal heme-containing protein.” EX1150, 1271;

EX1003(Tarte), ¶132.

Based on this interpretation, Petitioners Ground’s clearly disclose a meat-like-food product free of animal heme-containing proteins in specific forms (*e.g.*, ground meat) that produce meat-associated volatile compounds when cooked. Even if this interpretation is not adopted, Petitioner’s Grounds are unaffected because they map the prior art against the process limitations as well.

C. “a compound”

The independent claims recite “*a compound* selected from glucose...” and “*a compound* selected from cysteine....” The term “compound” has a plain meaning and does not require construction for purposes of this proceeding. EX1003(Tarte), ¶133. PO has implicitly taken the position in the Litigation that this term is not limited to *free* compounds of the claimed sugars and sulfur-containing precursors (*i.e.*, compounds not chemically bound to the structure of another compound) because PO alleges that Petitioner’s meat substitute products infringe the Challenged Claims even though Petitioner’s products are not made using free cysteine, cystine, methionine, or thiamine. *See* EX1116(SAC), ¶¶36, 51; EX1003(Tarte), ¶134. Hence, based on PO’s interpretation of the term, Grounds 1A-1C maps “*a compound* selected from cysteine...” to pea flour, which contains, for example, cystine, methionine, and thiamine. EX1003(Tarte), ¶¶135-36. Even if PO’s interpretation is not adopted, Grounds 1A-1C are unaffected because they map these terms to free

sugars and sulfur-containing precursor compounds as well.

VI. STATEMENT OF RELIEF REQUESTED

Petitioner requests *inter partes* review and cancellation of claims 1-23.

A. Grounds of Challenge

1A	1-9, 12-23	§103: Brown, Giacino
1B	2-3	§103: Brown, Giacino, Ronai
1C	10-11	§103: Brown, Giacino, Rolan
2A	1, 4-6, 8, 10, 13-23	§103: Rovaart, Conrad, Crane
2B	2-3	§103: Rovaart, Conrad, Crane, Ronai
2C	8-9, 14	§103: Rovaart, Conrad, Crane, Giacino
2D	11-12	§103: Rovaart, Conrad, Crane, Rolan
3A	1, 4-8, 10, 13-23	§103: Rovaart, Conrad, Proulx
3B	2-3	§103: Rovaart, Conrad, Proulx, Ronai
3C	8-9, 14	§103: Rovaart, Conrad, Proulx, Giacino
3D	11-12	§103: Rovaart, Conrad, Proulx, Rolan

VII. SUMMARY OF PRIOR ART

A. “Brown”

International Pub. WO/2013/010042(“Brown”), filed July 12, 2012, claims priority to U.S. provisional 61/572,205, filed July 12, 2011. Brown was published on January 17, 2013. Brown is prior art under both AIA and pre-AIA.

Under AIA: The '096 patent is not entitled to a filing date of January 11, 2013. *See* §IV. Thus, the effective filing date is no earlier than July 12, 2013, making it subject to the AIA.

Under the AIA, Brown is prior art under 35 U.S.C. §102(a)(1) because it was published on January 17, 2013. None of the §102(b)(1) exceptions apply. Brown is not a “disclosure...made by the inventor or joint inventor or by another who obtained the subject matter...from the inventor or a joint inventor.” §102(b)(1)(A). While Brown and the '241 patent share one inventor (Patrick Brown), the other Brown inventors are not inventors of the '241 patent, and thus Brown is not a disclosure “made by the inventor.” *See* MPEP §2153.01(a). There is also no evidence that the subject matter of Brown was disclosed in an earlier publication by the inventors. §102(b)(1)(B).

Under pre-AIA: If the '241 patent is entitled to a filing date of January 11, 2013, then the '241 patent would be subject to pre-AIA provisions. Yet even under those provisions, Brown is still prior art under pre-AIA §102(e) because it was filed

“by another” before the ’241 patent. MPEP 2136.04.

Brown discloses a plant-based “meat substitute composition” that “accurately mimics the taste, texture, or color of a meat product derived from animal sources.” EX1012, [0006], [00273], [00296]; EX1003(Tarte), ¶¶85-90.

B. “Rovaart”

U.S. Patent No. 3,930,044 (“Rovaart”) issued on December 30, 1975. Rovaart teaches methods “for preparing an expanded porous food product having a meat-like flavour,” including by heating a mixture containing “(b) a sulphur compound such as a sulphur-containing amino-acid, [and] (c) a pentose or hexose.” EX1125, Abstract; EX1003(Tarte), ¶91.

C. “Ronai”

U.S. Patent No. 4,153,738 (“Ronai”) issued on May 8, 1979. Ronai teaches a “dried flaked textured high vegetable protein material which instantly hydrates and has an improved flavor.” EX1132, 1:37-39. Ronai teaches that its textured soy protein flakes “can be used in an endless variety of ways to furnish vegetable protein as a meat protein substitute.” *Id.*, 8:55-9:1; EX1003(Tarte), ¶92.

D. “Giacino”

U.S. Patent No. 3,519,437 (“Giacino”) issued on July 7, 1970. Giacino discloses “artificial meaty flavoring compositions and...processes for preparing them.” EX1015(Giacino), 1:19-20. Giacino’s compositions include cysteine, ribose, and thiamine. EX1003(Tarte), ¶97.

E. “Conrad”

U.S. Patent No. 4,818,557 (“Conrad”) was issued on April 4, 1989. Conrad teaches “a meat replacement product to be used in mixed minced meat products, process for its preparation, and meat products comprising same, whereby the meat replacement product comprises the gluten protein and the bran fractions of whole cereal grain,” and to which “a blood hemoglobin fraction can be added.” EX1013(Conrad), Abstract; EX1003(Tarte), ¶¶98-99.

F. “Crane”

U.S. Patent Publication 2011/0287467 (“Crane”) was published on November 24, 2011. Crane teaches “methods of producing recombinant functional heme-binding proteins with complete heme incorporation and purified preparations” thereof. EX1014(Crane), Abstract; EX1003(Tarte), ¶¶100-101.

G. “Proulx”

“Iron Bioavailability of Hemoglobin from Soy Root Nodules Using a Caco-2 Cell Culture Model” (“Proulx”) was published on January 31, 2006. Proulx teaches the use of plant-derived soy leghemoglobin to fortify non-animal food products. *See* EX1019(Proulx), Abstract. Proulx demonstrates that “the bioavailability of hemoglobin from soy root nodules [is] similar to that of heme iron from animal sources” and can “provide a unique alternative fortificant” and “improve the iron status of the population.” *Id.*, 1521; EX1003(Tarte), ¶¶102-106.

H. “Rolan”

U.S. Patent Publication 2008/0268112 (“Rolan”) was published on October 30, 2008. Rolan discloses “meat analog compositions” that include antioxidants or fats for flavor. EX1021, Abstract, [0092]-[0093].

I. Proulx and MacLeod Are Printed Publications.

Proulx and MacLeod were indexed by libraries, and a POSITA could locate them through the exercise of ordinary diligence by 2006 and 1981, respectively. EX1009(Hall-Ellis), ¶¶65-73.

Proulx was published in the *Journal of Agricultural and Food Chemistry* on January 31, 2006, available through at least two libraries. EX1009(Hall-Ellis), ¶¶64-65. MacLeod was published in *Critical Reviews in Food Science and Nutrition* on August 31, 1981, and was available at the University of Wisconsin-Madison Libraries. *Id.*, ¶¶66-73. Both articles were published in reputable journals by reputable publishers and the dates on their face are reliable to a POSITA. EX1003(Tarte), ¶¶94, 103.

These exhibits are authentic copies of what was available before 2011. EX1009(Hall-Ellis), ¶¶65-73.

VIII. GROUNDS 1A-1C: BROWN, GIACINO, RONAI, ROLAN

Brown and Giacino render obvious claims 1, 4-9, 12-23 (Ground 1A). Adding Ronai renders obvious claims 2-3 (Ground 1B). Adding Rolan renders obvious claims 10-11 (Ground 1C). EX1003(Tarte), ¶¶137-279.

A. Ground 1A: Brown, Giacino

Brown discloses or renders obvious every limitation of the independent claims. Brown discloses a plant-based “meat substitute composition” that “accurately mimics the taste, texture, or color of a meat product derived from animal sources.” EX1012(Brown), [0006], [00273], [00296]. One exemplary formula for a “muscle replica” is combined with fat and connective tissue replicas to form a “meat replica.” The muscle replica comprises “pea flour, sunflower oil, and glucose” and is “heated for 10 minutes at 140C in the presence of... leghemoglobin (LHb),” producing volatile compounds that “are often associated with the aroma of cooked meat,” such as 2-octanone and 2-methyl-furan. EX1012(Brown), [00364]. Brown also teaches that heme can be used to generate meaty flavor/aroma. Giacino also discloses adding cysteine and thiamine, which have long been known to impart meat flavor, in the recited concentrations (if they have patentable weight) to food products. EX1015(Giacino), 1:60-68. Combining Brown and Giacino results in a composition that satisfies all limitations of the challenged claims.

1. Claim 1

(a) 1[pre] (“meat-like-food product”)

The preamble is not limiting. Brown’s muscle replica is added to other tissue replicas to form a meat substitute, *i.e.*, a “meat-like-food product,” and to impart a cooked meat aroma. EX1012(Brown), [00189], [00364]; EX1003(Tarte), ¶¶138-139.

(b) 1[a] (“plant protein(s)”)

Brown’s muscle replica comprises “pea flour,” which contains pea protein, *i.e.* a plant protein. EX1012, [00364]; EX1067(Meng), 235-236; EX1003(Tarte), ¶¶140-41. Brown also discloses that “any of the...muscle tissue replica[s]” comprise a “protein component” such as “the 8S globulin from Moong bean seeds, or the albumin or globulin fraction of pea seeds,” *i.e.*, plant proteins. EX1012, [00299], [00307]; EX1003(Tarte), ¶142.

(c) 1[b] (“heme-containing protein composition”)

Brown’s muscle replica further includes leghemoglobin, a heme-containing protein. EX1012, [0089] (“[M]uscle tissue replica further comprises one or more isolated and purified iron-containing proteins.”); [0095] (“[O]ne or more isolated and purified iron-containing proteins is leghemoglobin.”); [00364] (“A muscle replica...was heated for 10 minutes at 140C in the presence of...leghemoglobin.”); [00373]; EX1003(Tarte), ¶¶143-146.

As explained, the claimed heme-containing protein dry weight percentage lacks patentable weight. *See* §V.B. Regardless, Brown teaches that its “isolated and purified proteins [*i.e.* leghemoglobin] accounts for 90% or more of said protein content by weight,” and specifically, “leghemoglobin purification” of “95%.” EX1012, [0011], [0018], [00260]. A POSITA would understand that a 95% pure leghemoglobin composition would satisfy the 60% dry weight process limitation if

it had patentable weight. EX1003(Tarte), ¶¶147-48.

(d) 1[c] (“sugar(s) composition”)

Brown’s muscle replica further includes added “glucose.” EX1012, [00364]; EX1003(Tarte), ¶¶149-50.

(e) 1[d] (“sulfur-containing precursor(s) composition”)

Brown’s muscle replica includes pea flour.⁸ EX1012(Brown), [00364]. Pea flour contains cystine, thiamine, and methionine. EX1003(Tarte), ¶¶151-56; EX1050/1059(Jahreis), 39 (Table 2)(1.4% cystine, 0.9% methionine), 41 (legumes include thiamine); EX1057(Krumina-Zemture), 86 (Table 2)(0.15-0.16g methionine/100g); EX1106(USDA), 3, 6-7.

As explained, the claimed sulfur-containing precursor concentration lacks patentable weight. *See* §V.B. Alternatively, a POSITA would understand that Brown’s composition could be modified, and a POSITA would be motivated to include well-known flavor precursors such as cysteine and thiamine at the specified process concentrations to impart a beef flavor/aroma using ordinary skill in the art with a reasonable expectation of success. EX1003(Tarte), ¶¶157-180. For example, Giacino teaches “meaty flavoring compositions” with added cysteine and thiamine salts, including “EXAMPLE VI” shown below. EX1015, 1:19-20; 10:3-8.

⁸ To the extent “a compound” is interpreted to not be limited to free compounds, Brown’s muscle replica, which contains pea flour, satisfies this limitation. *See* §V.B.

Ingredient:	Parts by weight
L-cysteine hydrochloride -----	3.52
Hydrolyzed vegetable protein -----	154.70
Thiamine hydrochloride -----	3.52
Water -----	336.50
Taurine -----	10.00

It would have been obvious to combine Giacino's composition with Brown's muscle replica. Brown and Giacino are analogous art to the '241 patent, as they are directed to compositions for simulating meat flavor/aroma in non-animal food compositions. EX1003(Tarte), ¶161; EX1012(Brown), Abstract (“[C]ompositions related to plant-based meat substitutes”); EX1015(Giacino), 1:26-31 (“There is considerable demand for meat-flavored products in which the actual meat...is not needed or is actually undesirable.”).

A POSITA would be motivated to make this combination. EX1003(Tarte), ¶¶162-167. Brown invites a POSITA to modify its composition to add “amino acids” which result in “[c]haracteristic flavor and fragrance components...similar[] to meat.” EX1012, [00362]-[00363], [00295]. Giacino teaches “meat-like flavors are well-known” and there is “[c]onsiderable demand for meat-flavored products” without meat. EX1015, 1:26-31. Giacino's “novel flavor compositions” thus provide “meat flavor.” *Id.*, 2:47-48. Such compositions “can be used...in a wide range of food stuffs...as an aid in improving and enhancing existing flavor.” *Id.*, 1:65-67. Cysteine, especially, is “highly desirable.” *Id.*, 4:47-49, 5:17-18.

Based on these teachings, a POSITA would have been motivated to add

Giacino's beef-flavored composition to enhance Brown's composition. EX1003(Tarte), ¶167. Combined with Brown's glucose, a POSITA would know that this combination would create a more desirable meat flavor when cooked. EX1003(Tarte), ¶¶163-66; EX1005(McGorin), VIII.B; EX1015(Giacino), 6:3-7 ("The presence of [ribose, sucrose, dextrose (i.e. glucose)] results in...more intense flavor characteristics."). This is the application of a known technique to a known product ready for improvement, yielding the predictable result of enhanced meat flavor. EX1003(Tarte), ¶168.

Indeed, POSITAs were long-aware of the importance of amino acids (especially cysteine) to produce meat flavors. EX1003(Tarte), ¶¶163-66. MacLeod, a 1981 paper, provides a comprehensive overview of simulated meat flavorings known at the time, including "the importance of reducing sugars and amino acids," especially cysteine and thiamine, to provide meat-like flavor and aroma. EX1024(Macleod), 399 ("Whenever cysteine was used, recognizable beef aroma resulted ..."); 409 ("stress[ing] the importance of thiamin as a meat flavor precursor"). MacLeod provides a list of dozens of known volatile compounds created from heating glucose and cysteine, many of which provide natural beef aroma. EX1024(MacLeod), 313-356, 384; EX1003(Tarte), ¶165.

A POSITA also would have a reasonable expectation of success given the specific instructions provided by Giacino to prepare and add its beef-flavored

composition in the specific concentrations to food products. EX1003(Tarte), ¶168; EX1015(Giacino), 9:70-10:14. A POSITA would reasonably expect that combining Giacino's composition with Brown would result in a beef-flavored composition. EX1003(Tarte), ¶168. Accordingly, adding cysteine and thiamine in the claimed concentrations (as taught by Giacino) to Brown's composition results in a modified composition that satisfies this limitation.

Giacino also teaches at least a 1.5 mM concentration of cysteine and thiamine in its compositions. EX1003(Tarte), ¶¶169-80. Specifically, Giacino's "EXAMPLE VI" lists L-cysteine hydrochloride and thiamine hydrochloride each at 3.52 parts by weight, *e.g.*, 3.52 grams for a 508.24 gram beef-flavored solution, or 6.926 grams per 1 kg of solution (approximately 1.1 liter when the densities of the ingredients are considered). EX1003(Tarte), ¶175. One kilogram of solution also has 662 grams of water (0.66 liters). *Id.*, 178. "L-cysteine hydrochloride" and "Thiamine hydrochloride" contain, respectively, cysteine and thiamine combined with one molar equivalent of hydrogen-chloride—however, the cysteine and thiamine are not molecularly bonded to the hydrogen-chloride and thus they are free molecules. EX1003(Tarte), ¶¶176-77. Thus, 6.926 grams of cysteine hydrochloride is 5.324 grams of cysteine, and 6.926 grams of thiamine hydrochloride is 5.45 grams of thiamine. *Id.* Considering their respective molecular weights, this is about 44 millimoles of cysteine and 20.5 millimoles of thiamine. *Id.*

For concentration of solutes, a POSITA generally only considers the volume of the solute (*e.g.* cysteine or thiamine) and solvent (*i.e.* water), which results in a concentration of 66 mM for cysteine (44 millimoles per 0.66 liters) and 31 mM for thiamine (20.5 millimoles per 0.66 liters). *Id.*, ¶¶178-79.

If one were to use the volume of the entire solution (about 1.1 liters) to calculate the concentration, this would result in 40 mM for cysteine and 19 mM for thiamine. *Id.*, ¶180. Regardless, all of these values exceed 1.5 mM.

(f) 1[e] (“free of animal heme-containing protein”)

Brown’s leghemoglobin is a heme-containing protein sourced from plants or genetically modified yeast or bacteria, and none of the other ingredients in the muscle replica comes from animals. EX1012(Brown), [00364], [00376]-[00383]; EX1003(Tarte), ¶¶181-185. Moreover, to the extent combined, Giacino does not indicate that any of its compounds are sourced from animals. EX1003(Tarte), ¶¶186-190. Indeed, these compounds are routinely manufactured synthetically or obtained from plants. *Id.*.

(g) 1[f] (“production of at least two meat-associated aroma volatiles”)

Brown discloses that its muscle replica, when cooked, results in the production of at least “2-octanone, 2-methyl furan, which are often associated with the aroma of cooked meat, and *many other* unidentified compounds.” EX1012(Brown), [00364]; EX1003(Tarte), ¶¶191-92.

(h) 1[g] (“meat-like-food product in form selected from...ground meat”)

Brown’s composition “may be visually similar to or indistinguishable from ground beef or a particular cut of beef.” EX1012, [00272]; EX1003(Tarte), ¶¶193-94.

2. Claims 2-3 (“textured soy product”)

Brown’s composition includes “fibers compris[ing] a protein component,” which a POSITA would understand to be a textured vegetable/soy protein. It teaches that the “fibers are formed by extrusion of the protein component through an extruder.” EX1012(Brown), [00305]-[00306], [00310]; EX1003(Tarte), ¶¶195-99. The “protein component” is sourced from “soy...plants.” EX1012(Brown), [0049], [00300].

3. Claims 4-5 (“heme-containing protein composition”)

As explained, the claimed heme-containing protein dry weight percentages, for dependent claims 4 and 5—70% and 80%, respectively—lack patentable weight. *See* §V.B. Regardless, as discussed regarding limitation 1[b], Brown teaches adding a composition comprising leghemoglobin exceeding 70%/80% on a dry weight basis. EX1012(Brown), [0011], [0018], [00260]; EX1003(Tarte), ¶¶200-01.

4. Claim 6 (“heme-containing protein is a globin”)

Brown’s leghemoglobin is a globin. EX1003(Tarte), ¶202.

5. Claim 7 (“heme-containing protein amino acid sequence having at least 80% sequence identity to SEQ ID NOs. 1-26”)

Brown’s composition includes soy leghemoglobin (*see* §VIII.A.1, 1[b]), which a POSITA would understand has an “amino acid sequence having at least 80% sequence identity to” the ’241 patent’s SEQ ID NO 4—polypeptide of *Glycine max* leghemoglobin (*i.e.*, soy leghemoglobin). EX1001(’241 patent), 4:59-61; EX1003(Tarte), ¶¶203-04.

Moreover, Brown discloses that its composition’s heme-containing protein has “at least 98% homology to SEQ ID NO 1.” EX1012(Brown), [0089]-[0091]. Brown’s SEQ ID NO 1 has about 92% homology with the claimed SEQ ID NO 4. EX1003(Tarte), ¶¶205-11.

6. Claims 8-9 (“cysteine” and “thiamine”)

As explained, the claimed cysteine and thiamine concentrations lack patentable weight. *See* §V.B., VIII.B.1 (1[c]). As further explained, it would be obvious to a POSITA and they would be motivated to combine Brown’s composition with Giacino’s cysteine and thiamine, well-known flavor precursors, at the specified process concentration ranges to impart a beef flavor/aroma using ordinary skill in the art with a reasonable expectation of success. *Id.*; EX1003(Tarte), ¶212.

Indeed, Giacino teaches that “[i]t will be appreciated by those skilled in the art that variations in flavor can be obtained by altering...the proportions...of amino

acids employed...depend[ing] upon the personal preferences of the processor [and] consumer.” EX1015(Giacino), 3:31-36. Thus, Giacino provides “general guidelines,” for the amount of cysteine and thiamine that provide “suitable” flavors, including “0 to 2.5 weight percent cysteine” and “0.025 to 50 weight percent thiamine.” *Id.*, 5:1-10. For Giacino’s Example VI composition, the claimed range of 0.8-10 mM cysteine equals either 0.0064-0.08 w% cysteine (when considering volume of only solute and solvent) or 0.01-0.133 w% cysteine (when considering volume of the entire product), both of which fall within Giacino’s disclosed range of 0-2.5 w% . EX1003(Tarte), ¶¶213-214. For the claimed range of 0.1-2 mM thiamine, this equals either 0.0018-0.035 w% thiamine (when considering volume of only solute and solvent) or 0.003-0.06 w% thiamine (when considering volume of entire product), both of which overlap with Giacino’s disclosed range of 0.025-50 w%. *Id.*, ¶¶215-217.

A claimed range is disclosed by an overlapping prior art range if the prior art range is disclosed with “sufficient specificity.” *ClearValue Inc. v. Pearl River Polymers Inc.*, 668 F.3d 1340, 1345 (Fed. Cir. 2012). This is the case for Giacino’s cysteine and thiamine. Giacino discloses that its ranges provide “suitabl[e]” flavor. EX1015, 4:68. The ’241 patent places no importance on the recited cysteine and thiamine concentrations used in the method, merely disclosing certain concentrations of various sulfur-containing precursors for its exemplary

compositions without discussion of how the differences might affect flavor or aroma.

EX1003(Tarte), ¶218. For example, cysteine is disclosed at 10, 5, and 0.8 mM and thiamine is disclosed at 2, 1, 0.5 and 0.1 mM, all without comment. *Id.*; EX1001(241 patent), 44:19; 28:36; 79:12.

Moreover, a POSITA would understand that using a concentration within the claimed ranges would have simply been a matter of “routine experimentation.” *In re Aller*, 220 F.2d 454, 456 (CCPA 1955) (“Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.”); EX1003(Tarte), ¶219. As discussed, Giacino expressly states that the proportion of sulfur-containing precursors can be altered to find a desirable flavor and provides “suitabl[e]” ranges for such experimentation. EX1015,(Giacino) 3:31-36, 4:68. Cysteine and thiamine’s effect on flavor was already well understood for decades. EX1003(Tarte), ¶219; EX1024(Macleod), 399, 409.

7. Claim 12 (“sunflower oil”)

Brown teaches using sunflower oil in its meat-flavored composition. EX1012(Brown), [00364]; EX1003(Tarte), ¶¶220-21.

8. Claim 13 (“linoleic acid”)

Brown’s teaches that its muscle replica is added to other tissue replicas (*e.g.*, fat, connective tissue) to form a meat substitute product. EX1012(Brown), [00189],

[00191], [00364]. Brown's fat replica include fat droplets from "plant sources" including "linoleic acid." *Id.*, [00315]; EX1003(Tarte), ¶¶222-23.

9. Claim 14 ("heating...at 150°C for about 3 to about 5 minutes")

Brown's teaches that its composition produces volatile compounds when heated at 140°C for 10 minutes. EX1012(Brown), [00364]. A POSITA would recognize that heating the mixture at 150°C for 3-5 minutes would likewise result in a Maillard reaction and the release of volatile compounds. EX1006(McGorrin), ¶¶231-32; EX1015(Giacino), 6:26-31. Indeed, it would have been obvious to vary the temperature and cooking time as a matter of "routine experimentation." *In re Aller*, 220 F.2d at 456. A POSITA further would have been motivated to vary the temperature and cooking time. For example, a POSITA would be motivated to increase the temperature and reduce cooking time and a reasonable expectation of success in obtaining the expected result of a Maillard reaction that produces a meat-associated aroma. EX1003(Tarte), ¶¶224-228; EX1005(McGorrin), Sections V.B.

Alternatively, a POSITA would understand that the cooking time and temperature for Brown's composition could be modified and would be motivated to do so at the recited temperature and time to impart a beef flavor/aroma using ordinary skill in the art with a reasonable expectation of success. EX1003(Tarte), ¶228. As discussed, it would have been obvious to combine Brown and Giacino to add its flavor precursors to Brown (*see* §VIII.B.1 (1[d])). A POSITA would be

further motivated to incorporate Giacino's teachings regarding cooking temperature and time when adding its flavor precursors to impart a beef flavor/aroma. EX1003(Tarte), ¶¶229-234.

Giacino explains that its compositions are preferably heated to a temperature between 200°F (93°C) and 420°F (216°C) for between 15 seconds and 6 hours to induce the required reactions that produce the meaty flavor. EX1015(Giacino), 6:26-31. Giacino further explains that when heat exchangers are used, "the reaction mixture can quickly be brought to the reaction temperature and then quickly cooled in a second exchanger to a lower temperature at which no further reaction will take place." *Id.*, 6:48-52; *see also id.*, 6:68-71 (temperatures between 250°F (121°C) and 400°F (204°C) and heating times between 15 seconds and 3 minutes are preferred for heat exchangers). Hence, Giacino's disclosed heating temperatures and times overlap with those in claim 14. EX1003(Tarte), ¶¶229-31.

Giacino teaches that the temperature and duration can be altered to achieve "the desired flavor development." EX1015(Giacino), 6:38-39. This teaching shows that cooking temperatures and duration are routine experimentation, and well within the skill of a POSITA to adjust, as there is no indication that surprising or unexpected results will result from the claimed temperature and time. EX1003(Tarte), ¶232; EX1005(McGorin), ¶59.

A POSITA also would, in view of Giacino's finite number of predictable

temperatures/durations for cooking meat, find it obvious to try cooking Brown's composition at 150°C for 3-5 minutes, and would have reasonably expected the result of a Maillard reaction and release of volatile compounds having a meat-associated aroma. EX1003(Tarte), ¶233.

10. Claims 15-16 (“pink to red color before cooking”)

Brown's composition has “a pink color before cooking to indicate a raw state and causes the meat substitute product to transition to a white or brown color during cooking progression.” EX1012(Brown), [00366]; EX1003(Tarte), ¶¶235-38.

11. Claims 17-21 (specific volatile compounds)

Claims 17-21 claim the production of two, five, ten or twenty specific volatile compounds when the meat-like-food product is cooked. It was well-known that heating a composition containing cysteine and glucose/ribose, like Brown's composition by itself or the Brown and Giacino combination, produces dozens of volatile compounds, including at least the claimed number of specific compounds recited in claims 17-21. EX1003(Tarte), ¶¶239-50; EX1006(McGorin), §VII.A, VII.D; EX1024(MacLeod), 384 (Table 14 listing at least 20 of the specific claimed compounds); 385 (Table 15 listing 9 claimed compounds for cysteine/ribose); EX1045(Hofmann), Abstract (bis(2-methyl-3-furyl)disulfide produced through heating cysteine and ribose).

It was also well-known that heating L-cysteine hydrochloride, thiamine

hydrochloride, hydrolyzed vegetable protein and water, Giacino's Example VI **beef-flavor** ingredients, produces the volatile compound bis(2-methyl-3-furyl)disulfide, recited in claim 21, and that it provides an "intense roasted aroma." EX1141(Evers), 184; EX1003(Tarte), ¶250; EX1005, (McGorin), ¶34.

12. Claim 22

There is substantial overlap between independent claims 1 and 22. *See* §X.A.1. Claim 22 does not have the percentage/concentration process limitations in 1[b]/1[d] (which as discussed above lack patentable weight). Claim 22 is thus obvious (indeed, every limitation is expressly disclosed in Brown) for the same reasons discussed above with respect to claim 1. EX1003(Tarte), ¶¶251-58.

13. Claim 23 ("free of animal products")

Brown's composition does not contain animal products because it contains only non-animal ingredients including sunflower oil, glucose, soy leghemoglobin, and pea flour. EX1012(Brown), [00364]. A POSITA would understand that like sunflower oil, soy leghemoglobin, and pea flour, glucose is conventionally derived from plant starches, such as from corn, wheat, and potato. EX1089(Yebra-Biurrun), 479; EX1003(Tarte), ¶¶181-85, 259. Brown also discloses that its meat replicas are "entirely composed of ingredients derived from non-animal sources," including its "amino acids" and "sugars." EX1012(Brown), [00361]. Moreover, to the extent combined, Giacino does not indicate that any of its compounds are sourced from

animals, and such compounds are routinely manufactured synthetically or obtained from plants. EX1003(Tarte), ¶¶186-90.

B. Ground 1B: Brown, Giacino, Ronai (“textured vegetable/soy protein”)

Brown and Giacino in further view of Ronai render claims 2 and 3 obvious. EX1003(Tarte), ¶¶260-68.

A POSITA would understand that Brown’s composition (or the combined Brown-Giacino composition) could be modified and would be motivated to include well-known plant proteins, including texturized vegetable/soy proteins, to provide the same meat-like-food product using ordinary skill in the art with a reasonable expectation of success. *Id.*, ¶263. For example, Ronai teaches “the conversion of soybeans to texturized flakes” and the use of such “dried flaked textured high vegetable protein material [in food products] which instantly hydrates and has an improved flavor.” EX1132(Ronai), 1:37-39, 3:23-25.

As explained, Brown and Giacino are analogous art to the ’241 patent. *See* §VII.A.1 (limitation 1[d]). Ronai is also directed to flavor compositions for simulating meat flavors. EX1003, ¶265. Ronai teaches that its textured soy protein flakes “can be used in an endless variety of ways to furnish vegetable protein as a meat protein substitute,” and “to produce products which simulate...beef....” EX1132(Ronai), 8:55-68.

A POSITA would have been motivated to use Ronai’s texturized

vegetable/soy protein as the “isolated, purified [soy] proteins” in Brown alone or the Brown-Giacino composition, among other reasons, to simulate the texture of real meat. EX1012(Brown), [00299]; EX1003(Tarte), ¶266. Indeed, Ronai teaches the well-known benefits of using texturized vegetable/soy proteins, including that such proteins produce “a less beany flavor,” they are “easy to cook,” “dry, storable, light-tan-colored, palatable and appetizing in appearance,” “do not impart any unwanted taste to the final food product,” “have a consistency and cohesiveness,” “an improved texture without the need of texturizing agents,” and “provide a stable, lasting base to which color, flavor, nutrients and the like can be added,” all of which provide motivation to use Ronai’s textured product. EX1132(Ronai), 2:14-57; EX1003(Tarte), ¶266. Moreover, a POSITA would have understood that the Brown-Giacino combination could readily be modified to enhance the texture of the composition. EX1003(Tarte), ¶267. Indeed, Giacino analogously teaches that “[v]arious other materials and ingredients can be incorporated into the compositions.” EX1015(Giacino), 2:38-41.

A POSITA would have a reasonable expectation of success adding Ronai’s texturized vegetable/soy protein flakes to Brown or the Brown-Giacino combination using ordinary skill by simply mixing the ingredients. EX1003(Tarte), ¶268.

C. Ground 1C: Brown, Giacino, Rolan

Brown and Giacino in further view of Rolan render claims 10 and 11 obvious.

EX1003(Tarte), ¶¶269-79.

A POSITA would understand that Brown or the Brown-Giacino combination could be modified and would be motivated to include other well-known flavoring and antioxidant agents to enhance and preserve the composition's beef flavor/aroma using ordinary skill in the art with a reasonable expectation of success. *Id.* For example, Rolan teaches "meat analog compositions" that "have improved nutritional properties, such as reduced fat and cholesterol, without sacrificing flavor, texture, mouth feel, and aroma of ground meat" without real animal meat. EX1021(Rolan), [0002], [0017]; EX1003(Tarte), ¶¶272-73. Rolan teaches that other ingredients may be added including "antioxidant[s]...to increase the shelf-life or nutritionally enhance the...simulated meat compositions" and "flavoring agents to mimic or replace constituents found in lean meat." EX1021(Rolan), [0038], [0095], [0096]. Rolan discloses numerous antioxidants including claim 11's "beta-carotene," "caffeic acid," and "tocopherols." *Id.*, [0038], [0095]. Likewise, Rolan discloses numerous flavoring agents including "inosinic acid salts," which a POSITA would understand is claim 10's inosine monophosphate. *Id.*, [0096]; EX1003(Tarte), ¶272.

It would have been obvious to combine these antioxidants and flavoring agents from Rolan with Brown's muscle replica and the Brown and Giacino compositions. EX1003(Tarte), ¶274. Rolan, like Brown and Giacino, is analogous art to the '241 patent, as it is directed to meat analog compositions that simulate meat

flavor/aroma in non-animal food compositions. EX1003(Tarte), ¶275; EX1021(Rolan), [0006], [0017]; *see* §VIII.A.1.e.

A POSITA would be motivated to make this combination. EX1003(Tarte), ¶¶276-77. As explained, Brown invites a POSITA to modify its composition to add various ingredients that contribute to the “[c]haracteristic flavor and fragrance components...similar[] to meat.” EX1012(Brown), [00361], [00295]. Rolan teaches that antioxidants prevent the oxidation of fatty acids and oxidative color changes in its compositions, and that antioxidants may be natural or synthetic. EX1003(Tarte), ¶¶276-77; EX1021(Rolan), [0038]. Like Giacino, Rolan also teaches that its flavoring agents “may mimic or replace constituents found in lean meat or fat tissues...[to] provide an animal meat flavor, a grilled meat flavor, a rare beef flavor,” and such agents “may be natural...[or] artificial.” EX1003(Tarte), ¶¶276-77; EX1021(Rolan), [0096].

Based on these teachings, a POSITA would have been motivated to add Rolan’s antioxidant and flavoring agents to further enhance and preserve the Brown and the Brown and Giacino compositions’ beef flavor/aroma. EX1003(Tarte), ¶278. A POSITA would know that this combination is the application of a known technique to a known product ready for improvement, yielding the predictable result of enhanced and preserved meat flavor. *Id.*

A POSITA also would have a reasonable expectation of success making this

combination. Rolan provides specific antioxidant concentrations and flavoring agents that may be added to its compositions using ordinary skill, *i.e.*, mixing. EX1021(Rolan), [0095], [0096], [123]; EX1003(Tarte), ¶279. A POSITA would reasonably expect that combining Rolan's antioxidants and flavoring agents with Brown and the Brown and Giacino combination would enhance and preserve the beef flavor/aroma of the composition. EX1003(Tarte), ¶279. Accordingly, adding an antioxidant (such as "beta-carotene," "caffeic acid," or "tocopherols") and flavoring agent (such as inosinic acid salts, *i.e.*, inosine monophosphate) to the Brown and Brown and Giacino compositions results in a modified composition that satisfies the limitations of challenged claims 10 and 11.

IX. GROUNDS 2A-2D: ROVAART, CONRAD, CRANE, RONAI, GIACINO, ROLAN

Rovaart, Conrad, and Crane render obvious claims 1, 4-6, 8, 10, 13, and 15-23 of the '241(Ground 2A). Adding Ronai renders obvious claims 2-3 (Ground 2B). Adding Giacino renders obvious claims 8-9 and 14 (Ground 2C). Adding Rolan renders obvious claims 11-12 (Ground 2D). EX1003(Tarte), ¶¶280-419.

A. Ground 2A: Rovaart, Conrad, Crane

Rovaart is analogous art as it teaches "porous expanded food products having a meat-like taste," which can be prepared from "*substances rich in protein of plant...origin.*" EX1125(Rovaart), 1:5-13; EX1003(Tarte), ¶¶292-306. Rovaart provides that, because "it is desired to impart to [these products] the taste of meat,"

the products “are subsequently given a flavouring treatment.” EX1125, 1:24-26.

To this end, Rovaart teaches “preparing an expanded porous food product having a meat-like flavour,” comprising “at least one pentose or hexose [sugars],” “at least one sulphur-containing amino-acid or an amino-acid and a substance containing sulphur,” and “heating the mixture to a temperature of at least 150°C.” EX1125(Rovaart), 1:38-48. In addition to the desirable meaty flavors of Rovaart’s products, a POSITA would recognize Rovaart’s methods are advantageous because they are “particularly simple” and “the desired texture and taste are obtained in a single operation.” EX1125(Rovaart), 1:39-42; EX1003(Tarte), ¶294.

Rovaart discloses every limitation of the independent claims except the “heme-containing protein.” A POSITA would have modified Rovaart’s flavoring compositions to include a heme-containing protein based on Conrad’s and Crane’s teachings. Conrad discloses “the preparation of meat replacement products.” EX1013(Conrad), 1:11-14. Notably, Conrad discloses that adding hemoglobin (*e.g.*, heme-containing protein) to a composition “gives a desired taste improvement as it *improves the meat flavour* of the final product.” *Id.*, 4:3-16; EX1003(Tarte), §XIII.A.

Crane discloses the production of heme-containing proteins (*e.g.*, hemoglobin, myoglobin, and leghemoglobin) using recombinant expression systems. EX1014(Crane), Abstract, [0021], [0060]-[0062]. Crane’s teachings

obviate the need to extract select heme-containing proteins (*e.g.*, hemoglobin, myoglobin) from previously live animals. This avoids reliance on conventional animal husbandry and slaughter and/or costly and labor-intensive extraction methods traditionally needed to obtain these proteins. EX1003(Tarte), §XIII.A. Accordingly, adding heme-containing protein (as taught by Conrad and Crane) to Rovaart's composition results in a modified composition that satisfies all limitations of the independent claims.

1. Claim 1

(a) *1[pre] (“meat-like-food product”)*

The preamble is not limiting. Regardless, Rovaart teaches “the preparation of porous expanded food products having meat-like taste.” EX1125, 1:6-7. It discloses that the process “yields a product with a meat-like texture and the flavour of boiled beef.” EX1125(Rovaart), 6:26-27; EX1003(Tarte), ¶¶282-83.

(b) *1[a] (“plant protein(s)”)*

Rovaart teaches an embodiment of its product that comprises “defatted soya bean flour containing...53.5% protein,” *i.e.* a plant protein. EX1125, 3:33-34; EX1003(Tarte), ¶¶284-85. Rovaart also discloses preparing products from “*substances rich in protein of plant...origin.*” EX1125, 1:5-13. Rovaart's “process comprises forming a mixture comprising [] a finely divided food material,” which refers to “material in the form of particles...such as...a material *rich in protein*, for example *soya bean flour*....” EX1125(Rovaart), 1:42-44, 56-62.

(c) 1[b] (“*heme-containing protein composition*”)

Rovaart in view of Conrad and Crane render obvious a heme-containing protein composition. EX1003(Tarte), ¶¶286-341.

Rovaart generally motivates a POSITA to provide meaty flavor in products. EX1003(Tarte), ¶308. E.g., EX1125(Rovaart), 1:5-7 (“The present invention is concerned with *the preparation of* porous expanded *food products having a meat-like taste.*”). To this end, Rovaart teaches including “*suitable flavouring agents*” in its products, “which may be natural.” EX1125(Rovaart), 1:24-29.

Rovaart also teaches methods of *enhancing*—not merely producing—meaty flavor, which a POSITA would recognize as advantageous. EX1003(Tarte), ¶309. These methods include increasing the products’ cooking temperature, e.g., Rovaart teaches that “heating [Rovaart’s composition] at a temperature below 150°C does not produce the desired flavour.” EX1125(Rovaart), 2:46-51; EX1003(Tarte), ¶309. Rovaart also teaches that including undesirable ingredients can produce “less pronounced” meaty flavors. EX1125, 6:16-28; EX1003(Tarte), ¶310. Thus, Rovaart teaches the desirability of *enhancing* the meaty flavor of Rovaart’s products. A POSITA would recognize that one way is to include other “natural” “suitable flavouring agents” in the products, like adding a heme-containing protein to the plaintiff protein(s). EX1003(Tarte), ¶311.

(i) Motivation to Combine with Conrad

To further enhance Rovaart's products' meaty flavor, Conrad teaches that adding a composition that comprises a heme-containing protein would contribute to meaty flavor in addition to other benefits. EX1003(Tarte), ¶¶312-319.

Conrad discloses “grain meat”/“wheat meat” products that advantageously contain heme-protein (hemoglobin). In particular, Conrad teaches adding the “hemoglobin part” of slaughtered-animal blood to the grain-based “meat” confers multiple properties characteristic of meat: *First*, the color of the grain-based replica “*can advantageously be transferred into meat colour* by adding thereto...blood,” and *second*, the “*addition of blood/hemoglobin further gives a desired taste improvement as it improves the meat flavour of the final product.*” EX1013, 4:3-17; EX1003(Tarte), ¶¶312-13.

Conrad teaches levels of heme-protein in foodstuff products that achieve these desirable meat-like properties. Conrad discloses utilizing the “hemoglobin part of whole blood” in its grain-based “meat” (EX1012, 1:56-61, 4:5-10), which a POSITA would understand to primarily contain red blood cells that comprise hemoglobin protein. EX1003(Tarte), ¶¶314-19.

(ii) Motivation to Combine with Crane

A POSITA would be further motivated to substitute Conrad's blood-sourced hemoglobin with Crane's recombinantly-produced heme-proteins (i.e., non-animal heme-containing proteins). EX1003(Tarte), ¶¶320-331. *First*, a POSITA would be

motivated to substitute Conrad's conventionally-obtained hemoglobin with heme-proteins from alternative sources because obtaining blood from slaughtered animals incurs the same environmental consequences, expenses, and other ramifications as cultivating animals for meat. EX1003(Tarte), ¶321. Conrad teaches or suggests this motivation, as Conrad teaches utilizing meat replicas in place of "animal meat." EX1013, 1:25-40. Crane also teaches or suggests this motivation, as Crane teaches using its recombinant heme-proteins in place of conventionally-sourced proteins. EX1014, [0062] ("Recombinant hemoglobin preparations are used as effective and safe oxygen carriers as an alternative to blood transfusion."); EX1003(Tarte), ¶¶321-323.

Second, Conrad teaches avoiding conventionally-sourced meat due to its relative expense, and it teaches preparing its products with the aim of lowering costs of manufacture. EX1003(Tarte), ¶¶324-25; EX1013, 1:25-40 ("**replac[ing]** some of the *animal meat tending to be somewhat expensive* with...protein rich vegetable product," "would be desirable...from a cost benefit point of view..."). Crane also provides a motivation to address financial considerations associated with conventionally-sourced animal products. Crane teaches that heme-proteins can be produced via a "**simple and inexpensive method**" which "is effective at producing fully incorporated heme proteins." EX1014, [0085]; [0014] ("The present invention is a straightforward and **inexpensive method** for high fidelity incorporation of heme

into recombinantly overexpressed heme proteins.”); [0043] (“*fungal* [expression] *systems are more efficient and economical...*”).

Third, Crane’s heme-proteins can be purified, which is desirable for a commercial application such as foodstuffs like Rovaart’s meat substitute product (e.g., to achieve standardized ingredients and promote product stability)). EX1014, [0024], [0060]-[0062]; EX1003(Tarte), ¶326.

Crane teaches producing various heme-proteins. EX1014, [0021] (“The...heme-binding proteins...include...e.g., hemoglobin, myoglobin...leghemoglobin...”). A POSITA would be motivated to utilize Crane’s hemoglobin, myoglobin or leghemoglobin in Rovaart’s products, as a POSITA would expect doing so to contribute (1) desirable aroma/flavor, (2) desirable meat-like coloration, and (3) desirable meat-like nutrition. EX1003(Tarte), ¶¶327-38.

Aroma: As Crane’s recombinant hemoglobin is the same as Conrad’s hemoglobin, a POSITA would expect it to contribute to flavor in the same manner. EX1003(Tarte), ¶330. Likewise, as Crane’s recombinant leghemoglobin (found natively in plants) is a heme-protein like Conrad’s hemoglobin, a POSITA would expect it to contribute to flavor in the same manner as hemoglobin. EX1003(Tarte), ¶330.

Color: A POSITA would understand that heme-proteins (e.g., myoglobin and hemoglobin) are “predominant” red pigments in animal muscle and denature when

heated, causing meat's browning. EX1027, 64; EX1094, 82 (denaturation leads to "dull-brown" meat color). As Crane's recombinant hemoglobin and myoglobin are the same as those heme-proteins found in animal muscle, a POSITA would expect them to contribute to color in the same manner. EX1003(Tarte), ¶329. Likewise, leghemoglobin is structurally similar to myoglobin and provides meat-like color to plants. EX1030, 79 (leghemoglobin is "red pigment isolated from soybean root nodules"), EX1135(Nicola); EX1133(Hargrove). A POSITA would therefore expect Crane's recombinant leghemoglobin to achieve similar meat-like coloration in Conrad's grain meat as myoglobin/hemoglobin achieves in meat. EX1003(Tarte), ¶329.

Nutrition: Meat is an important dietary source of iron and "haem[sp:heme] iron [is] more readily absorbed and utilised by the body" than other forms. EX1029, 329. E.g., the heme-protein myoglobin provides 95% of the iron in beef muscle. EX1027, 64-65. Crane's recombinant hemoglobin, myoglobin, and leghemoglobin are "fully incorporated" with heme iron. EX1014, [0080], [0084]-[0085]; EX1003(Tarte), ¶331.

Lipid oxidation would not discourage a POSITA, because cooked lipid oxidation only produces off-flavors over time, whereas food products are intended to be consumed shortly after cooking. EX1003(Tarte), ¶¶332-37; EX1005(McGorin), §V.C, VIII.B. Lipid oxidation can also be mitigated with

antioxidants. *Id.*

A POSITA would have a reasonable expectation of success. Only ordinary skill is needed to mix Rovaart's ingredients with Conrad's recombinant hemoglobin and the improved meaty aroma from reaction of the combination was well-known and expected. EX1003(Tarte), ¶¶338-41; EX1005(McGorin), §V.B, V.D. Crane also teaches one of ordinary skill how to manufacture recombinant proteins. EX1007(Batt), ¶¶31-32, 49-53.

As explained, the claimed heme-containing protein dry weight percentage lacks patentable weight. *See* §V.B. Regardless, Crane teaches that recombinant protein production techniques produce highly pure heme-containing proteins. *See e.g.*, EX1014, 80:41-44, 84:34-36 (disclosing that the proteins were purified to >95% purity). A POSITA would understand that a ">95% purity" heme-containing protein composition would satisfy the 60% dry weight process limitation if it had patentable weight. EX1003(Tarte), ¶289. Conrad also discloses that for "the hemoglobin part separated off from blood, the protein content of which is about **90% by weight**," which refers to dry weight. EX1013 (Conrad), 4:3-17; EX1003(Tarte), 290. It was obvious to replace Conrad's animal-sourced hemoglobin with Crane's recombinant hemoglobin.

(d) *1[c], 1[d] ("sugar(s) composition" and "sulfur-containing precursor(s) composition")*

Rovaart teaches including the claimed sugars and sulfur compounds in its

products in order to achieve meat-like aromas. EX1003(Tarte), ¶¶342-51. As a POSITA would recognize, these sugars and sulfur compounds are Maillard reaction precursors long-known to produce volatile compounds associated with meaty aromas when heated. EX1005(McGorin) §III; *see* IX.A.1.e.(1[d]).

Rovaart provides, e.g., that its “process for preparing an expanded porous food product having a meat-like flavour...comprises forming a mixture comprising...at least one pentose or hexose” and “at least one sulphur-containing amino-acid or an amino-acid and a substance containing sulphur....” EX1125, 1:38-46. It further discloses that “[t]he pentose or hexose...may be *D-ribose*, *D-xylose*, *L-arabinose* or *glucose*,” and “[c]ysteine is the preferred *sulphur-containing* amino-acid...” EX1125(Rovaart), 1:66-2:1.

Rovaart’s examples disclose specific combinations of these sugar compounds with sulfur compounds. E.g., Example 1 comprises “83.3 g D-ribose, 66.7 g L-cysteine,” Example 2 comprises “D-Xylose” and “L-Cysteine,” Example 3 comprises “7.5 g ribose and 7.5 g cysteine,” and Example 4 comprises glucose and cysteine. EX1125(Rovaart), 3:32-37, 5:10-16, 5:38-40, 6:17-20.

As explained, the recited concentration lacks patentable weight, and thus, Rovaart discloses this limitation. *See* §V.B. Regardless, Rovaart’s “Example 1” embodiment of its food product comprises “3250 g of an aqueous solution containing...66.7 g L-cysteine....” EX1125, 3:35-39. 66.7 grams cysteine (550.5

millimoles) is about 186 mM concentration (when considering volume of just the solvent and solute (about 2.96 liters)) and 172 mM (when considering the volume of the entire aqueous solution), both of which exceed the claimed 1.5 mM. EX1003(Tarte), ¶351.

(e) 1[e] (“free of animal heme-containing protein”)

Rovaart’s “Example 1” embodiment comprises soya bean flour and an aqueous solution containing D-ribose, L-cysteine, sodium chloride, and calcium chloride. EX1125, 3:33-37. None of those ingredients contain animal protein nor animal heme-containing protein. EX1003(Tarte), ¶¶352-54.

Recombinant hemoglobin also satisfies this limitation under the PO’s infringement theory. EX1003(Tarte), ¶355; EX1116(SAC), ¶32. As explained for limitation 1[b], a POSITA would be motivated to combine Conrad with Rovaart to further enhance Rovaart’s products’ meaty flavor by adding heme-protein, and a POSITA would be further motivated to substitute Conrad’s blood-sourced hemoglobin with Crane’s recombinantly-produced heme-proteins including recombinant hemoglobin, myoglobin or leghemoglobin (i.e., a non-animal heme-containing protein) to create a meat-like product that PO alleges is free of animal heme-containing protein. EX1003(Tarte), ¶355; EX1116, ¶32.

(f) 1[f] (“production of at least two meat-associated aroma volatiles”)

Rovaart teaches cooking its meat-like products. EX1003(Tarte), ¶¶356-61.

Rovaart's process comprises "heating the mixture to a temperature of at least 150°C" under pressures "sufficient to produce a meat flavour in the interior of the final product." EX1125, 1:38-48, 2:63-68.

As a POSITA would recognize, heating the Rovaart products will naturally generate at least two volatile compounds associated with meat-like flavor/aroma. EX1003(Tarte), ¶358. The prior art has long taught that when sugars and sulfur compounds (like in Rovaart's products, e.g., ribose and cysteine or glucose and cysteine) are heated together, they undergo the Maillard reaction to produce many (i.e., "at least two") volatile compounds associated with meat-like flavors/aromas, including meat's character-impact compounds. EX1003(Tarte), ¶358; EX1024([MacLeod), 382, 384-85 (Table 14, Table 15); EX1005(McGorin, §V.A.1 (reviewing EX1017, EX1032–1034, EX1038, EX1041, EX1045, EX1099, EX1129).

This result is taught or suggested in Rovaart itself. EX1003(Tarte), ¶361. For example, heating Example 2's product (containing xylose/cysteine) "at 158°C" "provides *a product having the flavour of boiled beef* and a meat-like texture." EX1012, 5:10-36. A similar "boiled beef" flavor is produced when the same process is performed, substituting glucose for xylose. EX1012, 6:16-28 (Example 4). Heating Example 3's product (containing ribose/cysteine) "at 180°C" also produces a "*flavour...similar to that of roast beef*." EX1012, 5:38-49.

(g) *1[g] (“meat-like-food product in form selected from ground meat, a hotdog, a sausage, a roast, a meatball”)*

Rovaart teaches a meat-like-food product that has the texture and taste of various forms of meat. EX1003, ¶¶362-64. Rovaart’s process results in a “final product [that] has a fibrous structure analogous to the texture of meat and a meat-flavour.” EX1125, 1:38-48, 2:63-68. For example, Rovaart’s “Example 1” teaches that it is a “textured product” that is “ground.” EX1125, 4:15-17. A POSITA would understand that this embodiment has the form of ground meat. EX1003(Tarte), ¶363. Rovaart’s “Example 1” also discloses that when the dough exits the die, it “forms[s] a continuous cylinder of fibrous expanded material” with “a flavour analogous to that of roast chicken meat.” EX1125, 3:58-62. A POSITA would understand that this embodiment has the form of a hotdog, sausage, or roast. EX1003(Tarte), ¶363.

It also would have been obvious to mold Rovaart’s products into any one of the forms recited in the claims as a matter of “routine experimentation.” *In re Aller*, 220 F.2d at 456. A POSITA further would have been motivated to mold Rovaart’s products into obvious forms such as a hotdog, burger, ground meat or the like. Indeed, a POSITA would understand and be motivated to create these forms because they are forms consumers typically associate with meat, and they would have a reasonable expectation of success in creating these forms using ordinary skill, i.e., simple manipulation of Rovaart’s porous expanded food products. EX1003(Tarte),

¶364.

2. Claims 4, 5 (“heme-containing protein composition”)

As explained, the claimed heme-containing protein dry weight percentages for dependent claims 4 and 5—70% and 80%, respectively—lack patentable weight. *See* §V.B. Regardless, as discussed regarding limitation 1[b], Rovaart in view of Conrad and Crane discloses adding a composition comprising recombinant hemoglobin, myoglobin or leghemoglobin exceeding 70%/80% on a dry weight basis (*see* §IX.A.1 (1[b])). EX1003(Tarte), ¶¶365-70.

3. Claim 6 (“heme-containing protein is a globin”)

Rovaart in view of Conrad and Crane discloses a composition with a heme-containing protein (*see* §IX.A.1.c. (1[b])), and Crane discloses numerous heme-containing proteins that are globins. EX1014, [0021] (“The various classes of heme-binding proteins that are encompassed by the methods of the present invention include, without limitation, globins (e.g., hemoglobin, myoglobin, neuroglobin, cytoglobin, leghemoglobin)[.]”). EX1003(Tarte), ¶¶371-72.

4. Claim 8 (“cysteine”)

As explained, the claimed cysteine concentration lacks patentable weight, and thus, this claim is met with any amount of cysteine, which Rovaart discloses. *See* §V.B; EX1003(Tarte), ¶¶373-74. It also would be obvious to a POSITA and they would be motivated to modify Rovaart’s cysteine concentration to achieve a desired beef flavor/aroma using ordinary skill with a reasonable expectation of success.

EX1003(Tarte), ¶¶373-74. Indeed, it would have simply been a matter of “routine experimentation.” *In re Aller*, 220 F.2d at 456.

5. Claims 10, 13 (“inosine, IMP, guanosine, GMP, AMP” and “lactic acid”)

Rovaart’s Examples 2 and 5 disclose that the aqueous solution used to create its meat-like product contains “Inosine monophosphate” (EX1125, 5:20, 6:38) that gets “added to 1000 g of a defatted soya bean flour.” *Id.* 5:23-24. Rovaart also discloses that “flavouring and/or texturing agents such as sodium glutamate, inosine or guanosine monophosphate, lactic acid, calcium chloride or sodium chloride may also be added to the mixture.” EX1125, 2:18-21. A POSITA would have understood these ingredients could be added to Rovaart’s Example 1 or any other example for additional flavoring. EX1003(Tarte), ¶¶375-78.

6. Claim 14 (“heating at 150° C for about 3 to 5 minutes”)

Rovaart teaches that “heating [Rovaart’s mixture] at a temperature **below** 150° C does not produce the desired flavour and texture,” which a POSITA would understand to mean that heating at a temperature of 150° C will produce the desired meat-like flavor and texture. EX1125, 2:49-51; EX1003(Tarte), ¶¶379-81. Rovaart also notes that the mixture can be “heated at a temperature of...160°...C under a pressure of the order of 5 to 150 atmospheres” for “10 to 30 seconds.” EX1125, 2:63-65. Because products cook faster when cooked under pressure (especially under the extremely high pressure of 150 atmospheres), a POSITA would understand

from this disclosure that slightly reducing the temperature to 150° C and increasing the cooking duration to 3-5 minutes without being under the same pressure would still result in the production of the desired meat-like flavors and textures. EX1003(Tarte), ¶380.

Indeed, POSITA would understand, and it would have been obvious to vary the temperature and cooking time as a matter of “routine experimentation.” *In re Aller*, 220 F.2d at 456. A POSITA further would have been motivated to vary the temperature and cooking time. For example, a POSITA would be motivated to decrease the temperature and increase cooking time and have a reasonable expectation of success in obtaining the expected result of a Maillard reaction and release of volatile compounds. EX1003(Tarte), ¶381.

Alternatively, a POSITA would understand that the cooking time and temperature for Rovaart’s composition could be modified and would be motivated to do so at the recited temperature and time to impart a beef flavor/aroma using ordinary skill in the art with a reasonable expectation of success. As discussed below (§IX.C), it would have been obvious to combine Rovaart and Giacino. And for the reasons discussed for Claim 14 in Ground 1A (Brown, Giacino), Giacino discloses this limitation. *See* §VIII.A.8.

7. Claims 15, 16 (“pink to red color before cooking”)

Rovaart discloses that, after cooking the mixture, a product is obtained that is

“brown in colour” and has “a meat-like texture and a boiled beef taste....” EX1125, 6:48-50. It would be obvious to a POSITA to start with a pink or red color imparted by the heme-containing protein prior to being cooked to simulate real meat and heating will turn the final meat-like product brown after being cooked. EX1003(Tarte), ¶¶38-84.

A POSITA would understand that heme-proteins (e.g., myoglobin and hemoglobin) are “predominant” red pigments in animal muscle and denature when heated, causing meat’s browning. EX1027, 64; EX1094 (Suman), 82 (denaturation leads to “dull-brown” meat color).) Likewise, leghemoglobin is structurally similar to myoglobin and provides meat-like color to plants. EX1030, 79 (leghemoglobin is “red pigment isolated from soybean root nodules”), EX1135 (Nicola); EX1133 (Hargrove). A POSITA would therefore expect Crane’s recombinant leghemoglobin to achieve similar meat-like coloration (both before and after cooking) in Conrad’s grain meat as myoglobin/hemoglobin achieves in meat. EX1003(Tarte), ¶¶384.

8. Claims 17-21 (specific volatile compounds)

As discussed in Ground 1A, it was well-known that heating a composition like those in Rovaart’s embodiments, which contain cysteine and ribose (Example 1), or cysteine and glucose (Example 4), produces at least the claimed number of specific volatile compounds recited in claims 17-21. EX1003(Tarte), ¶¶382-95; EX1005,

(McGorin), §V.B, V.D; EX1024(MacLeod), 384 (Table 14 listing at least 20 of the specific claimed compounds for cysteine/glucose); 385 (Table 15 listing 9 claimed compounds for cysteine/ribose); 1045, Abstract (bis(2-methyl-3-furyl)disulfide produced through heating cysteine and ribose).

9. Claim 22

Clam 22 is obvious for the same reasons discussed in claim 1, and for the additional reason that claim 22 does not have the percentage/concentration process limitations. EX1003, ¶¶396-403.

10. Claim 23

As discussed above, Crane's recombinant hemoglobin and myoglobin are not "animal heme-containing proteins" under the PO's infringement theory, and Crane's recombinant leghemoglobin is a plant heme-containing protein. *See* §IX.A.1 (1[e]). The ingredients listed in Rovaart's Example 1 are also known not to be from animal sources. EX1003(Tarte), ¶¶404-05; EX1089, 479.

B. Ground 2B: Rovaart, Conrad, Crane, Ronai ("textured vegetable/soy protein")

Rovaart's composition includes protein from soya bean flour, i.e., vegetable/soy protein, that when used in its process "yields a product with a meat-like texture.". EX1125, 6:26-27, 1:42-44, 1:56-62, 3:33-34. Rovaart alone thus discloses or renders obvious claims 2 and 3.

To the extent Rovaart alone does not disclose the limitations of these claims,

as discussed in Ground 1B, Ronai discloses textured vegetable/soy protein. *See* §VIII.B. Thus, the combination of Rovaart, Conrad, and Crane with Ronai would have rendered obvious claims 2-3 for the same reasons set forth in Ground 1B. EX1003(Tarte), ¶¶406-08.

It would have been obvious to combine Ronai with Rovaart, Conrad, and Crane. As discussed above, all of these references are analogous art to the '241 patent. EX1003(Tarte), ¶407. Rovaart teaches that its composition use “material rich in protein,” such as “soy flour.” EX1125, 1:59-61. A POSITA would have been motivated to use Ronai’s texture vegetable/soy protein in place of Rovaart’s soy flour, especially since textured soy protein can be made from soy flour. EX1003(Tarte), ¶407. As discussed, Ronai teaches numerous benefits of using textured soy protein, all of which provide motivation to use Ronai’s textured product. EX1132(Ronai), 2:14-57; EX1003(Tarte), ¶¶260-68; *see* §VIII.B.

A POSITA would have a reasonable expectation of success combining Rovaart, Conrad, and Crane with Ronai. EX1003(Tarte), ¶408. Rovaart uses a “substance rich in protein,” such as soy flour, and Ronai’s textured soy protein is a concentrated protein. EX1125, 3:13; EX1132(Ronai), Abstract; 3:38-41. Moreover, Ronai teaches that its textured soy protein flakes “can be used in an endless variety of ways to furnish vegetable protein as a meat protein substitute.” EX1132(Ronai), 8:55-9:1. A POSITA would have reasonably expected success adding Ronai’s

textured soy protein flakes to Rovaart's compositions, e.g., merely substituting the ingredients, to improve texture and flavor. EX1003(Tarte), ¶408.

C. Ground 2C: Rovaart, Conrad, Crane, Giacino

As discussed in Ground 1A, Giacino discloses a beef flavor composition containing cysteine and thiamine and the concentrations of claims 8-9, and the specific cooking temperature and duration of claim 14. §VIII.A.5, VIII.A.8. As a result, the combination of Rovaart, Conrad, Crane, and Giacino render obvious claims 8-9 and claim 14. EX1003(Tarte), ¶¶409-414.

1. Claims 8 and 9 (“cysteine” and “thiamine”)

As explained, the claimed cysteine and thiamine concentrations lack patentable weight and thus Rovaart itself discloses at least claim 8's limitation. *See* §V.B., IX.A.4. Regardless, as explained in Ground 1A, it would have been obvious to combine Giacino's meat-flavor compositions to meet these limitations here in Rovaart's compositions. As discussed, Rovaart, Conrad, Crane, and Giacino are all analogous art to the '241 patent.

A POSITA would be motivated to make this combination. EX1003(Tarte), ¶411. Rovaart already notes the desirability for products to have a “desired texture and taste” that is “meat-like.” EX1125, 1:39-41. Indeed, Rovaart notes that “[c]ysteine is preferred.” EX1125, 1:68. Giacino itself notes “meat-like flavors are well-known” and there is “[c]onsiderable demand for meat-flavored products”

without meat. EX1015, 1:26-31. Giacino’s “novel flavor compositions” thus provide “a marked meat flavor.” *Id.*, 2:1, 2:47-48. Such compositions “can be used...in a wide range of food stuffs...as an aid in improving and enhancing existing flavor.” *Id.*, 1:65-67. Cysteine, especially, is “highly desirable,” and Giacino notes that only “small amounts of cysteine” need be used for beef flavors. *Id.*, 4:47-49, 5:17-18.

POSITAs were long-aware of the importance of sulfur-containing precursors (especially cysteine and thiamine) to produce meat flavors. EX1003(Tarte), ¶412. MacLeod, a 1981 paper, provides a comprehensive overview of simulated meat flavorings known at the time, including “the importance of reducing sugars and amino acids,” to provide meat-like flavor and aroma. EX1024, 399 (“Whenever cysteine was used, recognizable beef aroma resulted ...”); 409 (“Several patents stress the importance of thiamin as a meat flavor precursor”). EX1003(Tarte), ¶412.

Based on these teachings, a POSITA would have been motivated to add Giacino’s beef-flavored composition to enhance the meat flavor of Rovaart’s analog composition. EX1003(Tarte), ¶413. Rovaart invites the addition of amino acids and recognizes the desirability of meat flavor, and Giacino provides compositions that achieve meat flavor via cysteine and thiamine. Combined with the glucose or ribose found in Rovaart’s compositions, a POSITA knew this combination would create a more desirable meat flavor when cooked. EX1003(Tarte), ¶413;

EX1005(McGorin), §V.B; EX1015, 6:3-7 (“The presence of [ribose, sucrose, dextrose (i.e. glucose)] results in...more intense flavor characteristics.”). This was also the application of a known technique to a known product ready for improvement, yielding the predictable result of enhanced meat flavor. EX1003(Tarte), ¶413.

A POSITA would have a reasonable expectation of success given the specific instructions provided by Giacino in preparing its beef-flavored composition. EX1003(Tarte), ¶414; EX1015, 9:70-10:14. A POSITA would reasonably expect that using the mixture in Giacino would result in a beef-flavored composition that could be successfully added to Rovaart’s compositions for enhanced beef flavoring. EX1003(Tarte), ¶414.

D. Ground 2D: Rovaart, Conrad, Crane, Rolan

1. Claim 11 (“beta-carotene, alpha-tocopherol, caffeic acid”)

Rovaart, Conrad, and Crane in further view of Rolan render obvious claim 11.

Rolan discloses that “[t]he ground meat compositions may further comprise an antioxidant,” which include “beta-carotene,” “caffeic acid,” “tocopherols.” EX1021, [0095]; EX1003(Tarte), ¶¶415-416.

A POSITA would understand that the Rovaart, Conrad, Crane combination could be modified and would be motivated to include other well-known flavoring and antioxidant agents to enhance and preserve the composition’s beef flavor/aroma

using ordinary skill in the art with a reasonable expectation of success. EX1003(Tarte), ¶¶417-20. As explained in Ground 1C, Rolan teaches various antioxidants and flavoring agents. *See* §VIII.C.

It would have been obvious to combine these antioxidants and flavoring agents from Rolan with Rovaart's meat-like product and the Rovaart, Conrad, Crane compositions. Rolan, like Rovaart, Conrad, and Crane, is analogous art to the '241 patent, as they are all directed to producing meat flavors in foodstuffs. EX1003(Tarte), ¶418; EX1012, [0002], [0017]; EX1013, 1:11-14, 4:14-16; EX1014, Abstract, [0021], [0060]-[0062].

Rovaart, like Brown in Ground 1, teaches a POSITA to modify its composition to add various ingredients that enhance the meat-like flavor of Rovaart's food products. *See* §IX.A.1.c. Thus, for the same reasons explained in Ground 1C, a POSITA would be motivated to make this Rovaart, Conrad, Crane, Rolan combination to add Rolan's antioxidant and flavoring agents to further enhance and preserve the Rovaart, Conrad, Crane composition's beef flavor/aroma. *See* §VIII.C; EX1003(Tarte), ¶419. A POSITA would also have a reasonable expectation of success making this combination for the same reasons discussed for Brown in Ground 1C. *See* §VIII.C.

2. Claim 12 (“vegetable oil”)

Rovaart, Conrad, and Crane in further view of Rolan render obvious claim 12.

Rolan discloses that “[t]he ground meat compositions may further comprise...wheat germ oil.” EX1021, [0095]. A POSITA would understand that wheat germ oil is a vegetable oil. EX1003(Tarte), ¶416; EX1144. Rolan discloses that oils can be a type of “flavoring agent,” which “may provide an animal meat flavor, a grilled meat flavor, a rare beef flavor, etc.” EX1021, [0096]. Rolan also discloses that the “wheat germ oil” is an antioxidant. EX1021, [0095]. Thus, as explained for Claim 11 (§IX.D.1.), a POSITA would have been motivated to combine Rolan with the Rovaart, Conrad, Crane combination to further enhance the meat-like flavor and add the benefits of antioxidants. EX1003(Tarte), ¶420. A POSITA would have had a reasonable expectation of success in adding wheat germ oil because no more than routine skill (*e.g.*, measuring, mixing) would have been required. EX1003(Tarte), ¶420.

X. GROUNDS 3A-3D: ROVAART, CONRAD, PROULX, RONAI, GIACINO, ROLAN

Rovaart, Conrad, and Proulx render obvious claims 1, 4-8, 10, 13-23 (Ground 3A). Adding Ronai renders obvious claims 2-3 (Ground 3B). Adding Giacino renders obvious claims 8-9 and 14 (Ground 3C). Adding Rolan renders obvious claims 11-12 (Ground 3D). EX1003(Tarte), ¶¶421-54.

The primary difference between Grounds 2A-2D and Grounds 3A-3D is that Rovaart’s composition is combined with Proulx’s soy leghemoglobin instead of Crane’s recombinant hemoglobin. EX1003(Tarte), ¶422. The analysis for why

Rovaart, Crane, Ronai, Giacino, and Rolan disclose claimed elements is otherwise the same.

Proulx is analogous art because, as recognized by the '306 patent Examiner, Proulx provides a motivation to fortify foodstuffs with heme iron. EX1150, 1122-1125. Proulx teaches that, e.g., “[h]eme iron in the human diet is generally present in animal sources as a part of hemoglobin and myoglobin but is also found in” plant sources; however, plant heme-proteins “currently do not provide a significant amount of iron in human diets.” EX1019, 1518. Recognizing that “incorporation of animal-sourced heme iron is often unfeasible because of economic costs or because [of] cultural and religious barriers” (EX1019, 1521), Proulx teaches advantages of “use of plant hemoglobins for improving...human diet,” particularly leghemoglobin sourced from soybeans. EX1019, 1521; EX1003(Tarte), ¶¶423-25.

A. Ground 3A: Rovaart, Conrad, Proulx

1. Claim 1

As discussed in Ground 2A, Rovaart discloses limitations 1[pre]/22[pre], 1[a]/22[a], 1[c]/22[c]-1[d]/22[d], 1[e]/22[e] (with respect to non-heme ingredients), and 1[f]/22[f]-1[g]/22[g]. §IX.A. Rovaart, Conrad, and Proulx render obvious limitations 1[b]/[1e], *i.e.* a non-animal heme-containing protein. EX1003(Tarte), ¶¶439-51. As already discussed, Rovaart, Conrad, and Proulx are analogous art to the '241 patent.

Proulx's plant-sourced leghemoglobin is the same leghemoglobin protein (e.g., amino acid sequence) that can be produced using Crane's recombinant methods. EX1003(Tarte), ¶¶426-38, 441-45. A POSITA would therefore be motivated to combine Proulx's leghemoglobin with Conrad for the same reasons set forth in Ground 2 for Crane. *See* §IX.A.1.c. In particular, a POSITA would recognize that adding Proulx's soybean-sourced leghemoglobin to Conrad's meat replacement product (grain meat) would contribute the same desirable aroma/flavor, meat-like coloration, and nutrition to Conrad's grain meat as Crane's recombinant leghemoglobin. *See* §IX.A.1.c.

Proulx teaches additional motivations to combine its leghemoglobin with plant-based foodstuffs such as Conrad's "grain meat." EX1003(Tarte), ¶¶426-435. Proulx's underlying objective "is to introduce the concept of using plant hemoglobin as a heme iron source in" human diets, and it shows leghemoglobin has "great potential to be used as a fortificant for improving nutrition." EX1019, 1518, 1522.

Specifically, Proulx teaches that "[h]eme iron bioavailability has long been known to have higher bioavailability...than nonheme iron." EX1019, 1520. As taught in Proulx, soybean-sourced leghemoglobin "showed similar bioavailability" to bovine hemoglobin in a food matrix. *See, e.g.*, EX1019, Abstract, 1518, 1520, 1521 ("Our results showing the bioavailability of hemoglobin from soy root nodules similar to that of heme iron from animal sources when added with tortillas provide

a unique alternative fortificant, hence to improve the iron status of the population.”); EX1003(Tarte), ¶¶427-29. PO agrees. In its “generally recognized as safe” (GRAS) submission to the FDA for soy leghemoglobin, PO noted that bioavailability of iron in soy leghemoglobin is equivalent to that of bovine myoglobin when in a food-like substrate. EX1052, 7 (citing EX1019); EX1003(Tarte), ¶430.

A POSITA would also have been motivated to fortify Conrad’s “grain meat” with leghemoglobin because Proulx teaches the “high heat stability of...[heme] iron” compared to non-heme iron (EX1019, 1520, 1522), which a POSITA would recognize as advantageous in heated (cooked) foodstuffs. EX1003(Tarte), ¶429.

Proulx additionally teaches economic advantages of utilizing soybean leghemoglobin—e.g., that “[s]oy root nodules have no current use in agriculture production and as such may provide a novel value-added product for soy producers.” EX1019, 1522; EX1003(Tarte), ¶429.

A POSITA would also be motivated to mimic natural meat flavors, which, as taught by Rovaart and Conrad, could be achieved by combining sugars and leghemoglobin, such as a soy leghemoglobin as taught by Proulx. EX1003(Tarte), ¶¶431-435.

A POSITA would reasonably expect success in substituting Proulx’s leghemoglobin in Conrad’s wheat meat as Proulx teaches conventional extraction

and purification methods for obtaining soybean leghemoglobin from plants for use in foodstuffs, which would require only ordinary skill to practice. EX1003(Tarte).

¶¶436-38, 445. Proulx teaches that root nodules “were mechanically harvested...[and] ground...[T]he aqueous extract was also used to prepare partially purified LHb...by using...precipitation... Ion exchange chromatography...was used to further purify the LHb obtained from...precipitation.” EX1019, 1519 (describing “LHb Preparation” and bioavailability study design).

2. Claims 4-5

As explained, the claimed heme-containing protein dry weight percentages for dependent claims 4 and 5—70% and 80%, respectively—lack patentable weight. *See* §V.B. Regardless, as discussed regarding limitation 1[b], a POSITA would understand that Proulx’s disclosure of 73% pure hemoglobin refers to 73% of the isolated protein on a dry weight basis. EX1003(Tarte), ¶446; EX1019(Proulx), 1519-20.

3. Claim 6

Proulx’s leghemoglobin is a globin. EX1003(Tarte), ¶447.

4. Claim 7

The ’241 patent identifies the polypeptide of SEQ ID NO 4 as *Glycine max* leghemoglobin (i.e. soy hemoglobin). EX1001, 10:50-51. Hence, Proulx’s soy leghemoglobin satisfies this limitation. EX1003(Tarte), ¶¶448-49.

5. Claims 8, 10, 13-21

These claims are rendered obvious because they are disclosed by Rovaart as discussed in Ground 2A. EX1003(Tarte), ¶450.

6. Claims 22-23

Claim 22 is rendered obvious for the same reasons discussed in claim 1, and for the additional reason that claim 22 does not have the percentage/concentration process limitations. EX1003(Tarte), ¶451. Claim 23 is also rendered obvious for the reasons discussed in Claim 1 of Ground 2A—specifically, Proulx’s leg hemoglobin is a non-animal protein and Rovaart’s Example 1 lacks animal products. *Id.*

B. Ground 3B: Rovaart, Conrad, Proulx, Ronai

As discussed in Ground 2B, Ronai discloses claims 2-3 and it would have been obvious to combine Rovaart, Conrad, and Proulx with Ronai, for the same reasons. EX1003(Tarte), ¶452.

C. Ground 3C: Rovaart, Conrad, Proulx, Giacino

As discussed in Ground 2C, Giacino discloses claims 8-9 and 14 and it would have been obvious to combine Rovaart, Conrad, and Proulx with Giacino, for the same reasons. EX1003(Tarte), ¶453.

D. Ground 3D: Rovaart, Conrad, Proulx, Rolan

As discussed in Ground 2D, Rolan discloses claims 11-12 and it would have been obvious to combine Rovaart, Conrad, and Proulx with Rolan, for the same

reasons. EX1003(Tarte), ¶454.

XI. SECONDARY CONSIDERATIONS

No secondary considerations of non-obviousness support the patentability of the '241 patent claims.

A. No “Surprising” or “Unexpected” Results Support Patentability

PO filed several affidavits as part of the '241 application. EX1150('241 PH), 98-392. Identical affidavits were submitted during prosecution of the '096 patent in support of purportedly “surprising”/“unexpected” results from adding heme-protein (leghemoglobin) to ribose and cysteine compared. EX1002, 237-38, 241-373. PO's characterization is meritless.

PO's affidavits do not show that the resulting aroma of heme protein-containing reaction(s) better mimics the aroma of meat. PO's tests do not include a comparative sensory evaluation connecting any particular combination of volatile reaction products to the desired meaty aroma. EX1005(McGorrin), Section VIII.D.1. PO and its experts relied on literature teaching that certain compounds are associated with meaty aroma, but, without knowing the sensory impact of any particular profile of volatile components, the mere production of volatiles does not support finding that the resulting aroma is more meaty. *Id.*

Moreover, contrary to PO's expert's assertions (EX1002, 244-45), a POSITA would understand that merely increasing the amounts of certain compounds would

not necessarily increase the desired aroma and could affect it adversely. EX1005(McGorin), Section VIII.D.3; EX1017(Mottram), 421. Relatedly, four of the purportedly “novel” compounds produced by PO’s leghemoglobin-containing reactions are *not* exclusively related to a meaty or beefy aroma. EX1005(McGorin), Section VIII.D.4. Without sensory evaluation data it is unknown whether PO’s detected volatiles in fact produce a beefy aroma.

PO’s alleged unexpected/surprising results also lacks nexus. PO’s experimental evidence is not coextensive with the claimed sulfur and sugar compounds. EX1005(McGorin), Section VIII.D.5. PO’s experiments merely reflect the teachings of the prior art with respect to sulfur/sugar compounds as flavor precursors and use of heme-containing protein to produce meaty flavor. *Id.*

B. PO’s Volatiles Are Not Novel

Compounds, such as 2-methyl-3-furanthiol (MFT), bis(2-methyl-3-furyl)disulfide (MFT-MFT), 2-acetylthiazole, and thiophene, that PO urged were produced *exclusively* under the heme-containing conditions (EX1002, 244-45) are long known to be Maillard reaction products even in the absence of heme-containing proteins. EX1005(McGorin), ¶¶178-180; EX1045(Hofmann), Abstract; EX1093(Vauthey), Abstract; EX1118(Wang), Abstract. PO may argue that heme-containing proteins act as a catalyst to increase production of these compounds. But merely increasing volatiles does not increase aroma. EX1017(Mottram), 421;

EX1005(McGorin), Section X.D.3, ¶181.

C. A POSITA Would Not Be Discouraged from Adding a Heme-Protein to a Meat Replica

Conventionally sourced meat contains myoglobin and hemoglobin, which naturally contribute to meaty aroma when cooked. EX1005(McGorin), ¶132. A POSITA would recognize that, *over time*, heme-catalyzed oxidation could produce undesirable flavor, but this would not discourage a POSITA from incorporating a protein naturally present in meat into a meat replica. *Id.*, ¶¶133, 137.

Lipid oxidation could contribute positively to meaty flavor. EX1005(McGorin), ¶¶130-31. For example, Mottram teaches that phospholipids in meat “provide *lipid oxidation products during the initial cooking of meat which contribute to desirable aromas.*” EX1017(Mottram), 420; *see also* EX1022(Yamaguchi), [0026] (polyunsaturated fatty acids subjected to oxidation improve “body taste” of foods). Thus, it is inaccurate that lipid oxidation always exerts a negative impact on aroma. EX1005(McGorin), ¶¶134-136.

D. Other Objective Indicia

1. No Long-Felt-But-Unmet-Need, Skepticism, or Failure of Others

A 2021 study evaluated the aroma of eight plant-based burgers, including PO’s product. The study relied on gas chromatography analysis-mass spectrometry (GC-MS) *and* sensory evaluations. PO’s burger was not one of the top performers as it “gave off notes of yeast and grain,” which are not typical beef aromas.

EX1005(McGorin), ¶¶219-23. The burgers that came in first and second did not contain heme-containing proteins. *Id.*, ¶224. The winner's (Beyond Burger) improved aroma was due to its fatty acids, canola and coconut oil, which are more similar to animal fatty acids than the sunflower oil PO's burger product uses. *Id.*, ¶225. Hence, there is no "failure of others" or "long felt, but unmet need" that PO's products provide. *Id.*, ¶¶226-28.

2. No Nexus to Commercial Success

PO's plant-based burgers include the heme-containing protein leghemoglobin. EX1121, 2-3. Yet meaty, beef-like aroma is contributed by a variety of factors such as the volatile products of the Maillard reaction and lipid degradation, not simply the presence of heme-containing proteins. EX1005(McGorin), ¶¶231-32. Dr. McGorin explains that he is unaware of any nexus between leghemoglobin in PO's products and commercial success. *Id.*, ¶¶234-35. Rather, PO's commercial success is attributable to its aggressive marketing campaign. *Id.*, ¶¶238-39.

XII. INSTITUTION WOULD BE EQUITABLE

The Board should not exercise its discretion to deny institution under 35 U.S.C. §325(d). None of the present grounds was the basis for a rejection during prosecution. Grounds 2A-2D and 3A-3D rely on Rovaart as the primary reference, which was not cited, considered or discussed. Grounds 1A-1C rely on Brown as the

primary reference. While Brown was cited, it was not discussed by the examiner. However, the examiner also never questioned PO's claim of priority, nor did she have the benefit of Dr. McGorin's expert testimony on that issue, which likely explains why she did not consider Brown. Petitioner also relies, in part, on Ronai and Conrad, which were not cited or discussed during prosecution, as well as Giacino and Crane, which were cited but not discussed.

Instead, the examiner relied on Hsieh's *meat-based* composition as the primary reference, and the applicant's amendments during prosecution were largely directed to overcoming Hsieh's meat-based disclosure. By contrast, Petitioner relies on Brown and Rovaart's meat-free compositions, which is materially different and which the examiner never considered.

Lastly, with respect to Proulx, the examiner only considered it as a secondary reference to Hsieh, and thus it is not a basis to deny under 325(d). *St. Jude Medical, LLC v. Snyders Heart Valve LLC*, Case No. IPR2018-00105, Paper 15 at 12 (PTAB May 3, 2018). She relied on Proulx for the same reason Petitioner does—its disclosure of leghemoglobin—which PO did not dispute or attempt to overcome.

The examiner also did not have the benefit of expert testimony, as here, which weighs against exercise of discretion under §325(d). For example, Drs. Tarte and Batt opine that a POSITA would have been motivated to manufacture recombinant

heme-containing proteins and add them to food products. *See* §IX. The Examiner may not have appreciated that this was even possible.

XIII. CERTIFICATION

Petitioner certifies that the '241 patent is available for *Inter Partes* Review and that Petitioner is not barred or estopped from requesting this proceeding.

XIV. CONCLUSION

Petitioner has demonstrated a reasonable likelihood that the Challenged Claims are anticipated and/or obvious. Accordingly, review is requested.

XV. MANDATORY NOTICES

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

Motif Food Works, Inc. is the real party-in-interest.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

- 22-cv-00311-WCB, District of Delaware
- IPR2023-00206 ('096 Patent)
- IPR2023-00207 ('241 Patent)
- IPR2023-00208 ('250 Patent)
- IPR2023-00209 ('306 Patent)

C. Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3)) and Service Information (37 C.F.R. § 42.8(b)(3)-(4))

Petitioner provides the following counsel and service information. Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition.

LEAD COUNSEL	BACK-UP COUNSEL
Joseph M. Paunovich (Reg. No. 59,044) qeimpossibleipr@quinnemanuel.com <u>Postal and Hand Delivery Address:</u> QUINN EMANUEL URQUHART & SULLIVAN, LLP 865 S. Figueroa St. at 10 th Floor Los Angeles, California 90017 Tel: (213) 443-3000 Fax: (213) 443-3100	James Glass (Reg. No. 46,729) Sandra Haberny (Reg. No. 64,150) Razmig Messerian (Reg. No. 56,983) Quincy Lu (Reg. No. 76,954) qeimpossibleipr@quinnemanuel.com Sarah Cork (<i>pro hac vice</i> to be requested upon grant authorization) qeimpossibleipr@quinnemanuel.com <u>Postal and Hand Delivery Address:</u> QUINN EMANUEL URQUHART & SULLIVAN, LLP 865 S. Figueroa St. at 10 th Floor Los Angeles, California 90017 Tel: (213) 443-3000 Fax: (213) 443-3100

D. Service Information (37 C.F.R. § 42.8(b)(3)-(4))

Please send all correspondence to the lead and backup counsel at the addresses shown above. Petitioner consents to service by e-mail at the addresses of lead and back-up counsel shown above.

E. Payment of Fees (37 C.F.R. § 42.15(a))

The undersigned authorizes the Office to charge the fee required for this Petition for *Inter Partes* Review to Deposit Account No. 50-5708. Any additional fees that might be due are also authorized.

DATED: December 7, 2022

Respectfully submitted,

By: /s/ Joseph M. Paunovich
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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(a) and (d), the undersigned hereby certify that the PETITION FOR *INTER PARTES* REVIEW complies with the type-volume limitation of 37 C.F.R. § 42.24(a)(i) and (b)(i) permitting a petition of up to 14,000 words because, exclusive of the exempted portions, it contains 13,997 words as counted by the word processing program used to prepare the paper.

Date: December 7, 2022

Respectfully submitted,

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CERTIFICATE OF SERVICE

In accordance with 37 C.F.R. §§ 42.6(e) and 42.105, the undersigned certifies that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,224,241 and supporting materials were served on PO by USPS Overnight Express Mail at the following address of record for the subject patent:

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Attorney Docket No. 38767-0019002

Courtesy copies of the same documents were served on PO by USPS Overnight Express Mail at the following address of record for litigation counsel:

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Date: December 7, 2022

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