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FILM COATINGS AND FILM COATING COMPOSITIONS BASED ON CELLULOSIC POLYMERS AND LACTOSE

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The inclusion of lactose in the coating composition dramatically and unexpectedly improves adhesion of the film coating onto substrates such as pharmaceuticals, food, confectionery forms, agricultural seeds, and the like.

Claim

1. A dry film coating composition for use in pharmaceuticals, food, confectionery forms, agricultural seeds, and the like, comprising a cellulosic polymer in an amount from 11% to 56% by weight of the composition, and lactose.

14. A method of making a dry film coating composition for use in coating pharmaceutical tablets, food and confectionery forms, agricultural seeds, comprising mixing a cellulosic polymer and lactose together to form the dry film coating composition, the cellulosic polymer forming from 11% to 56% by weight of the composition, preferably from 20% to 30%.

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(54) Title: FILM COATINGS AND FILM COATING COMPOSITIONS BASED ON CELLULOSIC POLYMERS AND LACTOSE

(57) Abstract

A dry film coating composition for use in coating pharmaceuticals, food, confectionary forms, agricultural seeds, and the like, comprises a cellulosic polymer, and lactose. The composition may include an optional plasticizer, and an optional pigment. A method of coating substrates such as pharmaceutical tablets, food and confectionery forms, agricultural seeds, and the like comprises mixing a cellulosic polymer and lactose into water to form an aqueous coating suspension, spraying the coating suspension onto said substrates to form a film coating on said substrates, and drying the film coating on said substrates.

FILM COATINGS AND FILM COATING COMPOSITIONS BASED ON CELLULOSIC POLYMERS AND LACTOSE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of aqueous film coating of pharmaceutical, food, confectionery forms, and agricultural products, and is specifically concerned with providing coatings from a combination of a cellulosic polymer and lactose for coating such things as pharmaceutical tablets, pieces of candy, cereals, and agricultural seeds.

2. Description of the Prior Art

Film coating is a process of depositing a thin layer of material onto a substrate. Two goals of film coating substrates such as pharmaceutical tablets and the like are (1) to provide a functional protective barrier covering the outer surface of the

substrate, and (2) to provide a pleasing appearance.

The process of film coating pharmaceutical, food, confectionery, and agricultural pieces usually involves rolling the pieces in a pan, or suspending the pieces on a cushion of air, and continuously spraying a fine mist of atomized droplets of a coating suspension onto the pieces, the droplets coalescing on the surface of the pieces to form a film coating.

Coating suspensions having an organic solvent are undesirable since these solvents are often flammable, often toxic, and hazardous to the health of film coating workers. Further, reclaiming organic solvent fumes, which are given off during spraying, from exhaust air ducting systems is expensive and often required by law.

Water-based coating suspensions are desirable to avoid the drawbacks of organic solvent -based coating suspensions. However, a major problem with aqueous coating suspensions is poor adhesion of the film to the substrate.

SUMMARY OF THE INVENTION

A dry film coating composition for use in pharmaceuticals, food, confectionery forms, agricultural seeds, and the like, comprising a cellulosic polymer in an amount from 11% to 56% by weight of the composition, and lactose. Optionally, the composition may include a plasticizer and/or a pigment.

A method of coating substrates such as pharmaceutical tablets, food and confectionery forms, agricultural seeds, comprising mixing a cellulosic polymer and lactose into water to form an aqueous coating suspension, the cellulosic polymer forming from 11% to 56% by weight of the non-water ingredients;

spraying the coating suspension onto said substrates to form a film coating on said substrates;

and drying the film coating on said substrates.

The invention also includes the coated substrates, such as coated pharmaceutical tablets, and methods of making the dry film coating composition and of making a coating suspension.

Examples of the cellulosic polymer are hydroxypropyl methylcellulose and hydroxypropyl cellulose.

Exemplary of the plasticizer are polyethylene glycol having a molecular weight of 200 to 20,000, propylene glycol, or glycerol.

Any of the pigments heretofore used in making coating dispersions for coating tablets, food, confectionery forms, agricultural seeds, and the

like may be used. Examples are FD&C and D&C lakes, titanium dioxide, iron oxides or natural pigments.

The quantity of the cellulosic polymer is within a range of about 11% to about 56% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension. A range of about 20% to 30% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension is preferred.

The quantity of the lactose is within a range of about 11% to about 56% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension. A range of about 25% to 45% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension is preferred.

The quantity of the plasticizer is within a range of 0% to about 30% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension. A range of about 5% to 20% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension is preferred.

The quantity of the pigment is within a range of 0% to about 55% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension. A range of about 15% to

40% by weight of the dry film coating composition and of the non-water ingredients of the aqueous coating suspension is preferred.

A preferred formula for the present inventive dry film coating composition is:

COMPONENT	% w/w
CELLULOSIC POLYMER	26.80
LACTOSE	40.20
PLASTICIZER	8.00
PIGMENT	25.00

The following examples of the invention all disclose formulations which may be mixed into water to form an aqueous coating suspension effective to coat pharmaceutical tablets, food and confectionery pieces, and agricultural seeds. Seeds are advantageously coated to meet various needs, such as color coating for identification purposes, adhesion of various additives, (e.g., pest control agents and inocula), prevention of handling damage, and facilitating the use of mechanical planting equipment. The coated forms include medicinal tablets, vitamin tablets, aspirin tablets, capsules, chewing gum balls, candy pieces, breakfast cereals, and agricultural seeds.

EXAMPLES

The following examples illustrate the invention. All units and percentages used herein are by weight.

EXAMPLE 1

67.00 grams of hydroxypropyl methylcellulose (Methocel E15 made by Dow Chemical Company), 100.50 grams of lactose, 60.00 grams of titanium dioxide, and 2.50 grams of Indigo carmine aluminum lake 14% are loaded into a dry powder blender such as a P.K. blender and mixed vigorously for 25 minutes to form an homogenous mixture. Then, 20.00 grams of a plasticizer, polyethylene glycol 4000 (PEG 4000 made by Union Carbide), is added to the homogenous mixture and gently blended into it.

Optionally, the homogenous mixture containing the plasticizer is granulated using a planetary mixer, such as a Hobart planetary mixer. After the dry film coating composition is loaded into the mixer and the mixer is switched on, sufficient water is slowly added until the composition forms slightly adherent granules. These granules are then passed through a 1-2 mm screen and then dried in a 30°C oven until the moisture content is below 5%. The composition is then sieved again through a 1-2mm screen and is then ready for use in a non-dusting, granular form. If not optionally granulated in a planetary mixer, the powder may be milled such as in

a hammer mill (Apex Machinery, Dartford, England), for example.

Other methods of granulation which may be used are spray granulation and roller compaction.

The following examples 2 to 17, which show different formulations of the dry film coating composition of the invention, further illustrate the invention. In each example 2 to 17, a dry film coating composition is made using the procedure of Example 1. Methocel E15 and Methocel E50 are hydroxypropyl methylcellulose (HPMC) made by Dow Chemical Company. PEG 200, PEG 400, PEG 4000, PEG 8000, and PEG 20000 are polyethylene glycol made by Union Carbide. Klucel EF is hydroxypropyl cellulose made by Hercules Co.

EXAMPLE 2

COMPONENT	% w/w	grams
HPMC (Methocel E15)	20.39	50.98
LACTOSE	30.58	76.44
PEG 4000	30.00	75.00
TiO2	18.27	45.68
INDIGO CARMINE ALUMINUM LAKE 14%	0.76	1.90
	100.00	250.00

EXAMPLE 3

COMPONENT	% w/w	grams
HPMC (Methocel E15)	16.00	40.00
LACTOSE	24.00	60.00
PEG 4000	14.55	36.38
TiO2	43.64	109.10
INDIGO CARMINE ALUMINUM LAKE 14%	1.81	4.52
	100.00	250.00

EXAMPLE 4

COMPONENT	% w/w	grams
HPMC (Methocel E15)	55.83	139.57
LACTOSE	11.17	27.93
PEG 4000	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 5

COMPONENT	% w/w	grams
HPMC (Methocel E15)	11.17	27.93
LACTOSE	55.83	139.57
PEG 4000	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 6

COMPONENT	% w/w	grams
HPMC (Methocel E15)	15.66	39.15
LACTOSE	24.00	60.00
PEG 4000	5.34	13.35
TiO2	52.80	132.00
INDIGO CARMINE ALUMINUM LAKE 14%	2.20	5.50
	100.00	250.00

EXAMPLE 7

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 4000	8.00	20.00
IRON OXIDE YELLOW	25.00	62.50
	100.00	250.00

EXAMPLE 8

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 4000	8.00	20.00
TiO2	24.00	60.00
IRON OXIDE YELLOW	1.00	2.50
	100.00	250.00

EXAMPLE 9

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 4000	8.00	20.00
TiO2	1.00	2.50
INDIGO CARMINE ALUMINUM LAKE 14%	24.00	60.00
	100.00	250.00

EXAMPLE 10

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 400	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 11

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PROPYLENE GLYCOL	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 12

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
GLYCEROL	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 13

COMPONENT	% w/w	grams
HPC (Klucel EF)	26.80	67.00
LACTOSE	40.20	100.50
PEG 4000	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 14

COMPONENT	% w/w	grams
HPMC (Methocel E50)	20.83	52.07
LACTOSE	41.67	104.17
PEG 4000	6.25	15.63
TiO2	30.00	75.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.25	3.13
	100.00	250.00

EXAMPLE 15

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 8000	8.00	20.00
TiO2	24.00	60.00
TARTRAZINE ALUMINUM LAKE 25%	1.00	2.50
	100.00	250.00

EXAMPLE 16

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 20,000	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

EXAMPLE 17

COMPONENT	% w/w	grams
HPMC (Methocel E15)	26.80	67.00
LACTOSE	40.20	100.50
PEG 200	8.00	20.00
TiO2	24.00	60.00
INDIGO CARMINE ALUMINUM LAKE 14%	1.00	2.50
	100.00	250.00

Examples 18-20 illustrate additional formulations of the dry film coating composition of the invention.

EXAMPLE 18

A dry film coating composition having the following formula is made as in example 1, except that no plasticizer is blended into the composition:

COMPONENT	% w/w	grams
HPMC (Methocel E15)	29.13	72.82
LACTOSE	43.70	109.25
TiO2	26.08	65.20
INDIGO CARMINE ALUMINUM LAKE 14%	1.09	2.73
	100.00	250.00

EXAMPLE 19

A dry film coating composition having the following formula is made as in example 1, except that no pigment is blended into the composition:

COMPONENT	% w/w	grams
HPMC (Methocel E15)	35.73	89.33
LACTOSE	53.60	133.99
PEG 4000	10.67	26.68
	100.00	250.00

EXAMPLE 20

A dry film coating composition having the following formula is made as in Example 1, except that no plasticizer and no pigment are blended into the composition:

COMPONENT	% w/w	grams
HPMC (Methocel E15)	40.00	100.00
LACTOSE	60.00	150.00
	100.00	250.00

Each of the dry film coating compositions of Examples 1-20 is constituted in water to form a coating suspension. In each case, 170 grams of the dry film coating composition is dispersed into 830 grams of purified water. Preferably, this is accomplished by placing the 830 grams of purified water into a mixing vessel having the diameter that is about equal to the depth of the final suspension. Then, a low shear mixer is lowered into the water and turned on. Preferably, the mixing head of the mixer is about one third the diameter of the mixing vessel and creates a vortex from the edge of the vessel down to just above the mixing head. The 170 grams of the dry film coating composition is then added to the vortex at a rate where there is no excessive build-up of the dry film coating composition. The speed and depth of the mixing head is adjusted to avoid air being drawn into the

suspension which would result in foaming. The suspension is stirred for 45 minutes and is then ready for spraying.

The inventive coating suspensions are then sprayed onto medicinal tablets, vitamin tablets, aspirin tablets, capsules, chewing gum balls, candy pieces, breakfast cereals, and agricultural seeds, and allowed to dry. The film coatings so produced have an excellent appearance and adhere extremely well to the substrates.

Preferably, the inventive film coating suspension is formed by blending together all the dry ingredients of the coating formula, and then dispersing the mixture of the dry ingredients into water. However, the film coating suspension may be prepared by stirring the ingredients of the coating formulation one by one into water to form a coating suspension.

Further, the inventive coating suspension may be spray-granulated to form a dry edible film coating composition that may be remixed into water when desired to form a coating suspension.

The inclusion of lactose in the coating composition dramatically and unexpectedly improves adhesion of the film coating onto substrates such as pharmaceuticals, food, confectionery forms, agricultural seeds, and the like.

The dry film coating composition of the invention when constituted in water has a viscosity lower than that of a conventional polymer coating system having the same total solids. For an equivalent final dispersion viscosity as a conventional polymer coating system, a coating dispersion may be produced under the invention which has a higher solids loading, and consequently a lower solvent content. Accordingly, since the film coating suspensions of the invention may be sprayed at a higher solids level, spraying times are lower than the spraying times for conventional systems, which results in lower processing time cost.

Most cellulosic polymers show some degree of tack as they dry on the substrate surface. This tack is reduced with the inclusion of lactose in the inventive formula, thus further facilitating faster processing times, and thereby lowering costs.

The inclusion of lactose in the inventive formulation improves the light stability of organic pigments and natural colors commonly used in film coatings.

The inclusion of lactose in the formulation has the effect of reducing the moisture vapor permeability of the film.

The Claims defining the invention are as follows:

1. A dry film coating composition for use in pharmaceuticals, food, confectionery forms, agricultural seeds, and the like, comprising a cellulosic polymer in an amount from 11% to 56% by weight of the composition, and lactose.

2. A dry film coating composition according to claim 1 in which the cellulosic polymer is present in an amount from 20% to 30%.

3. A dry film coating composition according to either claim 1 or claim 2, further comprising a plasticizer.

4. A dry film coating composition according to claim 3, in which the plasticizer is polyethylene glycol 200 to 20,000, propylene glycol, or glycerol.

5. A dry film coating composition according to claim 3 or 4, in which the plasticizer content is up to 30% by weight of the composition.

6. A dry film coating composition according to any preceding claim further comprising a pigment.

7. A dry film coating composition according to claim 6, in which the pigment is at least one of FD&C lakes, D&C lakes, titanium dioxide, iron oxides, or natural pigments.

8. A dry film coating composition according to either claim 6 or claim 7 in which the pigment content is up to 55% by weight of the composition.

9. A dry film coating composition according to any preceding claim in which, the cellulosic polymer is hydroxypropyl methylcellulose or hydroxypropyl cellulose.

10. A dry film coating composition according to any preceding claim, in which the lactose content is from 11% to 56% by weight of the composition.

11. A dry film coating composition according to claim 1 formed from 40% by weight cellulosic polymer and 60% by weight lactose.

12. A method of coating substrates such as pharmaceutical tablets, food and confectionery forms, agricultural seeds, comprising mixing a cellulosic polymer and lactose into water to form an aqueous coating suspension, the cellulosic polymer forming from 11% to 56% by weight of the non-water ingredients;

spraying the coating suspension onto the substrates to form a film coating on the substrates; and

drying the film coating on said substrates.

13. A method according to claim 12 in which the cellulosic polymer forms from 20% to 30% by weight of the non-water ingredients.

14. A method of making a dry film coating composition for use in coating pharmaceutical tablets, food and confectionery forms, agricultural seeds, comprising mixing a cellulosic polymer and lactose together to form the dry film coating composition, the cellulosic polymer forming from 11% to 56% by weight of the composition, preferably from 20% to 30%.

15. A method according to claim 12 further comprising granulating the dry film coating composition.

16. A method of making a dry film coating composition for use in coating pharmaceutical tablets, food and confectionery forms, agricultural seeds, comprising mixing a cellulosic polymer and lactose into water to form an aqueous coating suspension, the cellulosic polymer forming from 11% to 56% by weight of the non-water ingredients, preferably from 20% to 30%, and spray granulating the aqueous coating suspension to form a dry film coating composition.

17. A method according to either claim 12 or claim 16, further comprising adding a plasticizer to the aqueous coating suspension.

18. A method according to either claim 14 or claim 15 further comprising mixing a plasticizer with the cellulosic polymer and the lactose until blended to form the dry film coating composition.

19. A method according to either claim 17 or claim 18 further comprising the plasticizer being polyethylene glycol 200 to 20,000, propylene glycol, or glycerol.

20. A method according to any one of claims 17, 18 or 19 in which the plasticizer content is up to 30% by weight of the non-water ingredients of the composition.

21. A method according to any one of claims 12, 16 and 17 or to claim 19 or 20 when dependent on any of claims 12, 16 and 17, further comprising dispersing a pigment into the coating suspension.

22. A method according to any one of claims 14, 15 or 18 or to claim 19 or 20 when dependent on any one of claims 14, 15 or 18, further comprising adding a pigment to the mixture and mixing until the combined mix is blended to form the dry film coating composition.

23. A method according to claim 21 or 22 in which the pigment is at least one of FD&C lakes, D&C lakes, titanium dioxide, iron oxides, or natural pigments.

24. A method according to any one of claims 21, 22 or 23 in which the pigment content is up to 55% by weight of the non-water ingredients of the coating suspension.

25. A method according to any one of claims 12 to 24 in which the cellulosic polymer is hydroxypropyl methylcellulose or hydroxypropyl cellulose.

26. A method according to any one of claims 12 to 25, in which the lactose content is from 11% to 56% by weight of the non-water ingredients of the coating suspension.

27. The method of any one of claims 12, 14, 15 or 16 in which 40% by weight cellulosic polymer is mixed with 60% by weight lactose.

28. An aqueous coating suspension for coating substrates such as pharmaceutical tablets, food and confectionery forms, agricultural seeds, comprising a mixture of

a cellulosic polymer,

lactose, and

water,

the cellulosic polymer forming from 11% to 56% by weight of the non-water ingredients.

29. An aqueous coating suspension according to claim 28 in which the cellulosic polymer forms from 20% to 30% by weight of the non-water ingredients.

30. An aqueous coating suspension according to either claim 28 or claim 29, further comprising a plasticizer.

31. An aqueous coating suspension according to claim 30, in which the plasticizer is polyethylene glycol 200 to 20,000, propylene glycol, or glycerol.

32. An aqueous coating suspension according to either claim 30 or claim 31, in which a plasticizer content is up to 30% by weight of the non-water ingredients of the coating suspension.

33. An aqueous coating suspension according to any one of claims 28 to 32 further comprising a pigment.

34. An aqueous coating suspension according to claim 33, in which the pigment is at

least one of FD&C lakes, D&C lakes, titanium dioxide, iron oxides, or natural pigments.

35. An aqueous coating suspension according to either claim 33 or claim 34, in which the pigment content is up to 55% by weight of the non-water ingredients of the coating suspension.

36. An aqueous coating suspension according to any of claims 28 to 35, in which the cellulosic polymer is hydroxypropyl methylcellulose or hydroxypropyl cellulose.

37. An aqueous coating suspension according to any of claims 28 to 36, in which the lactose content is from 11% to 56% by weight of the non-water ingredients of the coating suspension.

38. An aqueous coating suspension according to claim 28 in which the non-water ingredients of the coating suspension are 40% by weight cellulosic polymer and 60% by weight lactose.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/00383

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :C08L 1/10
US CL :106/176,203,204; 427/394; 426/93,103; 424/480
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : NONE

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A, 4,302,440 (JOHN ET AL) 24 NOVEMBER 1981 See entire document	1-4,11-16,26-29
Y,P	US,A, 5,098,715 (MCCABE ET AL) 24 MARCH 1992 See entire document	1-4,11-16,26-29

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/00383

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 5-10,17-25,30-35
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.