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(54) Title: IMPROVEMENTS IN THE HERBICIDAL TREATMENT OF PLANTS

(57) Abstract

This specification investigates the use of blocking agents for use in herbicidal compositions. Preferred blocking agents are generally lipids, including fats, oils and waxes. Use of esters is discussed though fatty acids are generally considered unsuitable on their own due to transport problems. In many cases the blocking agents are hydrophobic and generally require the use of a lipophilic or non-aqueous solvent. The use of suitable solvents is also discussed herein, as are methods of use of a herbicide composition.

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IMPROVEMENTS IN THE HERBICIDAL TREATMENT OF PLANTS

TECHNICAL FIELD

This invention relates to improvements in the herbicidal treatment of plants. More specifically, this invention proposes a method of herbicidal treatment of plants whereby unwanted plants and grasses may be terminated using a compound or substance which has a blocking type action that is either non-toxic or has a low level of toxicity to animals and humans.

BACKGROUND ART

A wide range of chemicals are used to control pests and weeds in the agricultural industry. Their aim is to prevent either insects or animals from destroying crops or to prevent weeds and unwanted plants competing with the desired crop.

At present, there are two main classes of herbicidal chemicals, those which have a "contact" action upon plants, and those which have a "systemic" action upon plants. Some herbicides have both a contact and systemic action on plants. Other herbicides are also available, for example soil sterilants.

Herbicides may either be selective or non-selective. Selective herbicides, for example "Treflan" (trifluralin), may be utilised for the selective destruction of certain types of grass. Non-selective herbicides such as "Roundup" (glycophosphate) may be used as a general herbicide for destroying or controlling many different types of plants and grasses.

A wide number of herbicides and plant hormones have been developed over the years. In the early days inorganic compounds such as sodium chlorate and sodium arsenite and various borate compounds were used. There were also developed other organic herbicides such as N-phenyl-carbamate, "Randox", and other chlorinated phenoxy compounds. In addition, industrial waste products were quite common. Later on, the hormone type weed killers 2,4-D (2,4-dichloro-phenoxyacetic acid) and 2,4,5-T (2,4,5-trichloro-phenoxyacetic acid) were developed, and have become quite common. More complicated organic weed killers and proprietary chemicals such as "Network" or "Roundup" (both glyphosphates) have also been developed.

In many cases herbicides have deleterious effects, for example, they may poison the desired crops, affect other plants or animals, and/or poison the soil. Most chemical herbicides are dangerous to mankind and are therefore dangerous when accidentally inhalated and/or absorbed into human and animal tissue.

Because of the widespread concern of the deleterious side effects of currently available herbicides, and the problems associated with absorption and ingestion into other living matter, there is also much concern as to the long-term use of these complex and highly dangerous chemicals, especially when they enter into the food chain.

There has been developed recently a relatively non-toxic herbicide which has fatty acids as its main constituents. This herbicide has a smothering effect on plants, however it is not effective in killing perennial weeds. The herbicide also tends to be effective only against the leaves of a plant, and does not have any significant effect upon the root systems of plants. A

further disadvantage is that the fatty acids are not readily carried or emulsified within an appropriate carrier fluid or solvent, which lessens its overall effectiveness due to its inability to permeate into or be transported to or into the plant cells.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a herbicide composition comprising a blocking agent within a suitable solvent or carrier.

According to a further aspect of the present invention there is provided a composition for use as a plant herbicide comprising a blocking agent capable of effecting plant mechanisms such as plasmolysis, osmolysis, delamination, dissolution and/or dehydration of a plant, in conjunction with a solvent therefore.

According to a further aspect of the present invention there is provided a method for the herbicidal treatment of plants comprising the administration of a composition including a blocking agent capable of inducing one or more potential blocking mechanisms, including plasmolysis, osmolysis, delamination, dissolution and dehydration to plant tissue.

The invention proposes a method of herbicidal treatment of plants whereby unwanted plants and grasses may be terminated using a herbicidal compound which has a blocking type action that is either non-toxic or has an extremely low level of toxicity to animals. The herbicidal compound preferably comprises a blocking agent (to be defined later herein), dispersed in a suitable solvent or carrier fluid to enable the herbicidal or blocking agents such as common fats and lipids to permeate into or be transported to the plant cells.

The herbicidal or blocking agents generally act to block the transport of liquid in the stem of plants. One common fault is to prevent the normal process of nutrient migration to the leaf for the synthesis of glucose by photosynthesis or other water-salt transport. The migration of the blocking agent, and in some cases the solvent, to or into the plant cells can also cause complex metabolic changes, some already known, that result in herbicidal action on the cells. The application of a herbicide according to the present invention either stop the production and/or transportation of sugars and other food from leaves to other parts of the plant via the phloem, or in stopping the conduction of water and salts from the root system from the xylem, or a combination of both.

It is well established that the hydraulic forces causing the transport of liquid through the capillaries (phloem and xylem) are large and that evaporation from leaf during the transpiration operation also provides a driving force for liquid movement through the stem of the plant. The combination of potential blocking mechanisms, and other mechanisms such as plasmolysis, osmolysis, delamination, dissolution, dehydration, and the like to the xylem tissue and the phloem tissue, as well as possibly the cambium and other cell layers, are ideal methods to prevent continued growth of the

plant and thereby kill it with application of only non-dangerous or relatively non-toxic compounds.

Initial Experimental Work

In this specification, the term "blocking agent" shall be understood to describe an agent which has the effect of preventing or hindering the production and/or transportation or sugars and other foods or liquids from leaves to other parts of the plant via the phloem, and/or an agent which prevents the conduction of water and salt from the root system from the xylem, or a combination of both. The term "blocking agent" also includes agents which cause or have an effect on plant mechanisms such as plasmolysis, osmolysis, delamination, dissolution, and dehydration.

Most embodiments of the present invention shall make use of lipids as the blocking agent. While the lighter oils and fats may be more convenient to use due to increased miscibility or solubility with a carrier, fats and waxes of higher molecular weight may sometimes provide a more lasting or effective blocking agent. While some heavier waxes may be difficult to dissolve in a suitable solvent carrier, more soluble waxes may be used in many embodiments of the present invention. Typically a lipid suitable for use in the present invention will be characterised in that it is substantially hydrophobic (to resist in the predominantly aqueous processes within the plant) and that it will be soluble in a suitable non-aqueous solvent.

Many embodiments of the present invention will make use of naturally occurring fats. Most fats contain a high proportion of triglycerides and other esters of the fatty acids. The use of such esters and other derivatives, either in the form of a fat, oil, wax or specific compound, overcomes part of the previous problems associated with the use of fatty acids in herbicidal

compositions. Many of the ester derivatives present in many natural fats have an acid portion typically in the C_{10-20} range. Typically, the esters of these compounds (which is generally with a glycerol) are relatively mobile within the plant enabling its transport within the plant so that it may act as a blocking agent. However useful compounds of other molecular weights and degrees of mobility may also be used within the present invention, though the time taken for herbicidal action may vary.

Tallow is another useful lipid comprising a high percentage of glyceride esters of C_{14-18} acids, among other components.

The use of lipids as blocking agents in the present invention, may use naturally occurring substances such as tallows, animals fats, vegetable oils and so forth. However it is envisaged that such naturally occurring substances also contain a variety of other components which, while they may provide some blocking action, may not be as effective as other components. Consequently it is envisaged that some embodiments of the present invention will be based on synthetic mixtures or derived fractions from natural substances. It is though that the hydrophobic and lipophilic portions of lipids (such as many esters) are likely to be most effective as a blocking agent and some embodiments may comprise predominantly these constituents.

These components may also be useful as a means for transporting other components such as fatty acids, which can also exhibit some blocking capability though have in the past been limited in their use because of an apparent transport problem. The use of the fatty acids may be desirable, or required in some instances, with the slightly more hydrophilic -COOH portion being attracted to some plant cells. The formation of a micellar type coating about a plant cell undoubtedly provides a blocking action. While

fatty acids and other organic acids may be useful, research has illustrated that blocking action can be obtained in their absence (for instance see the use of petroleum jelly, below).

In early work common animal fats were dispersed either in kerosene or mineral turpentine to transport the dispersed fat into the vascular tissue and cells of plant sub-layer. Plants such as nutgrass, kikuyu, creeping oxalis, clover, and the like were killed in a very short period. Other solvents used included pine and cooking oils, which were potentially less harmful to animals. Other fatty products such as butter and heavy cooking oils as well as margarine were also tried as blocking agents with various carrier liquids. In addition "Vaseline", a petrochemcial compound, was also found to block the cells and hold the solvent in the plant stem and therefore kill the weeds. It was also established that the applications worked better on hot days, indicating that the pumping effect caused by the transpiration action in the leaves also increased the rate at which these processes occurred. It was also found that the addition of certain compounds, such as wood ash would increase the plasmolysis effect caused by the concentration differential across the cell wall and subsequent loss of water from the cell.

Hence, simple fatty and waxy substances dissolved or dispersed in a suitable solvent were seen to be transported into the vascular tissue of plants thereby blocking and killing the plant cells and preventing liquid transportation. In some cases the fatty material was found to have been transported to the base of the cell thereby preventing root action where water and salts from the soil are absorbed and conducted up the stem to the shoots.

Having regard to the above initial experimental work, it has been found that the blocking agent(s) referred to previously may preferably be fats or

fatty compounds, as these are particularly effective as blocking agents. Any type of fat or fatty compounds may be utilised, and in any required or desired combination thereof. It is found that common lard or animal fats are particularly useful as blocking agents.

The blocking agents may preferably be dispersed within a suitable carrier fluid or solvent. Preferably, the blocking agents and solvents or carrier fluid may be emulsified. Any suitable solvents may be utilised.

Factors (all of which may or may not be present) which make a potential solvent attractive for use are low molecular weight, low viscosity, a dissolving action upon plant tissues or cells, non-toxicity, and the ability to produce an adequate emulsion, solution or suspension with the blocking agent. Solvents which are found to be particularly effective are pine oil, cooking oils of low viscosity, and pinus mugo pumillio. Oils used are commonly animal or plant derived though mineral oils could also be used (though some biodegradability may be desirable for solvents used). Solvents such as mineral turpentine or kerosene may also be utilised, however they have a higher toxicity, increased flammability and are therefore less desirable.

Water may also be added to the carrier fluid or solvent. A main advantage of doing so is so that the resulting herbicide is less flamable than without the addition of water. However, only small amounts of water should be added otherwise the overall effectiveness of the herbicide is reduced. The use of non-flammable chlorinated solvents could also be effective but may be considered less environmentally sound. However some of those solvents are also good lipid solvents.

Any other additives may also be utilised as required or desired to increase plasmolysis, osmolysis, delamination, dissolution, dehydration, and other such actions to increase the rate and extent of effectiveness of the blocking agent and solvent.

A wide range of fats and waxy materials have been used at various concentrations and in various solvents, and applied to selected grasses and weeds. Any solvents could be used and fatty material can even be dispersed in water as a stable emulsion so that simple systems can be used to destroy normal plant life action. In some cases the solvents used have been found to extract compounds from tar seal, bitumen roadways and sidewalks to prevent completely the regrowth of the plant.

A preferred method of accelerating the herbicidal action is either to cut the lethal material from the stem at or near ground level, or to apply the herbicide directly to the base of the stem of a plant or grass.

In operation, the stem and leaves of the grass or weeds protruding above the ground are cut and the blocking herbicide emulsion applied to the open stem or directly to the base. The ingress into the plant of the fatty material dispersed in the solvent, by diffusion and capillary action as well as the subsequent asmotic effects, causes the fatty substances to be transported into the phloem or xylem and other cells, thereby precipitating or blocking and preventing the normal expiration of the cell and possibly also plasmolysis, osmolosis, cellular delamination, blocking and self-choking of the tissue actions.

The present herbicide and treatment method provides an effective alternative for replacing conventional dangerous, toxic, complex hormonal and complex herbicidal chemicals from being used, particularly in public

parks, private grounds, footpaths, driveways, home gardens and lawns where it is possible that domestic animals, children and other living organisms can come in contact with the chemicals or treated plants.

The examples as outlined above do not preclude the use of other organic or inorganic substances being added to accelerate the plasmolysis effects or increase the rate of which the fatty substances block the vascular tissue and other cells. For example, organic additives such as wood ash or blood and bone extract may be utilised. Inorganic additives increasing ion concentrations, such as sulphate of ammonia, urea, sulphate of potash, and/or nitrates and sulphates of other cations. Sodium chloride may also be effective. These additives appear to have the effect of causing a higher concentration of nutrient ions, which result in an overly strong plasmolysis effect which ultimately kills the plant's cells.

Trials over a long period have shown that these additional substances are easy to use, are relatively non-toxic and provide a sensible alternative to the use of dangerous complicated and potentially troublesome herbicides.

BEST MODES FOR CARRYING OUT THE INVENTION

The following examples illustrate the more effective embodiments developed by the inventor. It is noted that different plant matter will respond differently to different formulations, and thus some trial and experimentation by the user to determine the most effective formula will be required. However the following examples cover a range of different situations and plant types, and will be a useful guide in formulating the most effective preparation.

In most cases the lipid of choice, as a blocking agent, is a fat. For convenience, an animal fat has been used, which is readily available at low

cost. Other fats, waxes and oils could also be used though for simplicity of description, the word fat has been used herein. Tallow can also be readily substituted for the fat in the following examples.

The solvents listed in the following examples comprise predominantly oils but other lipophilic solvents may also be used. Esters of C_{10-20} acids with C_{1-4} alcohols are generally suitable in many instances.

1. Mix: 1 measure animal fat, 1 measure vegetable (cooking) oil. Trials have found this mixture to be particularly effective in killing kikuyu and nut grass. Roots and all leaf material were killed in 1 week of hot summer weather.

2. Mix: 2 measures fat, 1 measure pine oil. Trials have found this mixture to be particularly effective in killing kikuyu and nut grass, clover, creeping oxalis, paspalum, and similar roots. Roots and all leaf material were killed in 1 week of hot summer weather.

3. Mix: 1 measure fat, 1 measure fine cooking oil, 1/2 measure tea tree (New Zealand Manuka) oil. Current results indicate this mixture is useful as a general herbicide for action against all types of plant and grass material.

4. Mix: 2 measures fat, 1 measure pine oil, 1/2 measure leptospermum wood ash. Current results indicate this mixture is useful as a general herbicide for action against all types of plant and grass material.

5. Mix: 2 measures fat, 1 measure pine oil, and 1 measure water and 1/4 measure coconut oil. Current results indicate this mixture is useful as a general herbicide for action against all types of plant and grass material.

6. Mix: 2 measures pinus mugo pumillio and 3 measures beef fat. This mixture was found to kill a wide range of weeds and grasses. The time taken for the plants and grasses to die was from 1-3 days A preferred method of accelerating the herbicidal action is either to cut the lethal material from the stem at or near ground level, or to apply the herbicide directly to the base of the stem of a plant or grass.

In operation, the stem and leaves of the grass or weeds protruding above the ground are cut and the blocking herbicide emulsion applied to the open stem or directly to the base. The ingress into the plant of the fatty material dispersed in the solvent, by diffusion and capillary action as well as the subsequent asmotic effects, causes the fatty substances to be transported into the phloem or xylem and other cells, thereby precipitating or blocking and preventing the normal expiration of the cell and possibly also plasmolysis, osmolosis, cellular delamination, blocking and self-choking of the tissue actions.depending upon the exposure of the plants to heat and/or sunlight.

It is considered that once the solvent or carrier liquid has provided for the transportation of the blocking agent into the cell walls of the plant, the blocking agent then has the effect of retaining the solvent or carrier liquid within the plant tissue and/or plant cells. Thus, the solvent or carrier liquid may act directly on the cells walls of the plant, often resulting in the delamination and/or dissolution of same, at the same time that the blocking agent is having its effect.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE:

1. A herbicide composition comprising a blocking agent to be combined with a suitable solvent and/or carrier.

2. A herbicide composition as claimed in claim 1 in which said blocking agent is a lipid.

3. A herbicide as claimed in any one of the preceding claims in which said blocking agent comprises an animal or vegetable fat or oil.

4. A herbicide composition as claimed in any one of the preceding claims in which said blocking agent includes a glyceride ester.

5. A herbicide composition as claimed in any one of the preceding claims in which said blocking agent includes an ester of a C_{10-20} acid.

6. A herbicide composition as claimed in any one of the preceding claims in which a said blocking agent is hydrophobic.

7. A herbicide composition as claimed in any of the preceding claims in which said blocking agent is lipophilic.

8. A herbicide composition as claimed in any one of the preceding claims when a said solvent or carrier fluid comprises an oil.

9. A herbicide composition as claimed in claim 8 wherein said oil is an animal or plant derived oil.

10. A herbicide composition as claimed in any one of the preceding claims in which a said solvent or carrier is lipophilic.

11. A herbicide composition as claimed in any one of the preceding claims in which a said solvent or carrier fluid comprises at least one member of a group comprising: pine oil, low viscosity vegetable oils, pinus mugo pumillio.

12. A herbicide composition as claimed in any one of the preceding claims in which a said solvent or carrier fluid comprises an ester.

13. A herbicide composition as claimed in claim 12 in which a said ester comprises a C_{1-4} derivative of a C_{10-20} acid.

14. A herbicide composition as claimed in any one of the preceding claims which includes water.

15. A herbicide composition as claimed in any one of the preceding claims which includes a chlorinated and/or halogenated solvent.

16. A herbicide composition as claimed in any one of the preceding claims which includes an agent augmenting or creating a plasmolysis effect due to a concentration differential across a cell wall in tissue of a target plant.

17. A herbicide composition as claimed in claim 16 wherein said agent comprises at least one member of a group comprising: wood ash, blood and bone, sulphate of ammonia, urea, sulphate of potash, nitrates, sulphates and sodium chloride.

18. A composition for use as a plant herbicide comprising a blocking agent capable of indicing blocking mechanisms in plants such as plasmolysis, osmolysis, delamination, dissolution and/or dehydration of a plant, in conjunction with a solvent therefor.

19. A composition as claimed in claim 18 in which said mechanisms are induced in the xylem or phloem tissue of the plant.

20. A method for the herbicidal treatment of plant matter comprising the administration of a composition as claimed in any one of the preceding claims.

21. A method for the herbicidal treatment of plants comprising the administration of a composition including a blocking agent capable of inducing one or more potential blocking mechanisms, including plasmolysis, osmolysis, delamination, dissolution and dehydration to plant tissue.

22. A method as claimed in claim 21 in which said blocking mechanisms affect at least the xylem or phloem tissue of plants.

23. A method as claimed in either claim 21 or claim 22 in which said blocking agent comprises a lipid.

24. A method as claimed in any one of claims 21 through 23 wherein said blocking agent forms a micellar layer about plant cells or lining plant tissue.

25. A method as claimed in any one of claims 21 through 24 in which said method includes the use of a solvent capable of transporting said blocking agent within the plant.

26. A method as claimed in any one of claims 21 through 25 which includes the addition of an agent increasing the concentration differential of ions across a cell wall.

27. A method as claimed in any one of claims 21 through 24 in which at least one member of a group comprising (wood ash, blood and bone, sulphate of ammonia, urea, sulphate of potash, nitrates, sulphates and sodium chloride) is included or co-administered to said plant.

28. A composition substantially as described herein with reference to the contained examples.

29. A method substantially as described herein with reference to the contained examples.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ92/00023

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[5] A01N 37/02, 37/04, 37/06

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)
IPC: A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: A01N 37/02, 37/04, 37/06. Australian classification 87.16, 87.120

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)
DERWENT DATABASE: WPAT - KEYWORDS: LIPID(S), FAT(S), FATTY, WAX(ES), GLYCERIDE(S) TRIGLYCERIDE(S), TALLOW, PETROLEUM JELLY, VASELIN, HERBICIDE CHEMICAL A01N 37/10, ABSTRACTS; CASA: - KEYWORDS: LIPID(S), FAT(S), FATTY, WAX(ES), GLYCERIDE(S), TRIGLYCERIDE(S), TALLOW, VEGETABLE OILS, HERBICIDE(S), 05/CC, 19/CC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	WO 91/05472 (Safer Inc) 2 May 1991 (02.05.91) entire document	1-3, 7-9, 10, 11, 14, 16, 18, 20, 21, 23, 25
X	WO 91/05471 (Safer Inc) 2 May 1991 (02.05.91) entire document	1-3, 7, 16, 18, 20, 21, 23, 25
X	US 2626862 (P W Zimmerman et al.) 27 January, 1953 (27.01.53) entire document	1-3, 7, 16, 18, 20, 21, 23, 25

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

"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

"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

"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

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Date of the actual completion of the international search	Date of mailing of the international search report
23 July 1993 (23.07.93)	6 AUG 1993 (6.08.93)
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. 06 2853929	Authorized officer CARMELA MONGER Telephone No. (06) 2832486

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	US 3645716 (A J Ruthowski) 29 February, 1972 (29.02.72) entire document	1-3, 7, 8, 9, 10, 16, 18, 20, 21, 23, 25
X	Phytochemistry, volume 24 No. 12 1985, M Entzeroth et al. 'A herbicidal fatty acid produced by Lyngbya aestuarii', pages 2875-2876 whole article	1-3, 4, 6-7, 18, 20, 21, 23
X	Phytochemistry, volume 27 No. 10, 1988, N G Muraleedharan et al.; 'A new fatty acid methyl ester and other biologically active compounds from Aspergillus niger	1-3, 4, 6-7, 18, 20, 21, 23
A	Weed Science, volume 34, (1986), J A Nalewaja et al.; 'Absorption and translocation of herbicides with lipid compounds', pages 564-568	
A	AU 26252/88 (Safer Inc) 20 April 1989 (20.04.89)	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ92/00023

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

This international search report has not 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. ☒ Claim Nos.: 1
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.:
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.

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
WO	91054/72	EP	495876		
WO	91054/71	EP	495792		
AU	26252/88	EP	335961	WO	8903178

END OF ANNEX