

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE SCOTTS COMPANY LLC
Petitioner

v.

ENCAP, LLC
Patent Owner

Case IPR2013-00110
Patent 6,209,259

Before MICHAEL P. TIERNEY, LORA M. GREEN, and RAMA G. ELLURU,
*Administrative Patent Judges.*¹

PER CURIAM.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

¹ Floyd, Administrative Patent Judge, who participated in the oral hearing held on January 30, 2014, has left the Board; accordingly, Tierney, Administrative Patent Judge, has been added to the panel.

I. BACKGROUND

Petitioner, The Scotts Company LLC (“Scotts Company”), filed a Petition on January 10, 2013, for an *inter partes* review of claims 1-5, 7-11, 13, and 14 (“the challenged claims”) of U.S. Patent No. 6,209,259 (“the ’259 patent”) pursuant to 35 U.S.C. §§ 311-319. Paper 2. On April 15, 2013, Patent Owner, Encap, LLC (“Encap”), filed a Preliminary Response. Paper 9. On July 3, 2013, the Board granted an *inter partes* review for all challenged claims on less than all of the grounds of unpatentability alleged in the Petition. Paper 12, (“Dec.”). The Board also stayed concurrent reexamination of the ’259 patent. Paper 10.

After institution of trial, Encap filed a Corrected Patent Owner’s Response. Paper 48. Encap also filed a Corrected Contingent Motion to Amend Claims that requests substituting proposed new claims 15-24 for claims 2-5, 8-11, 13, and 14, respectively—contingent upon a determination of unpatentability. Paper 47. Scotts Company filed a Reply to Patent Owner’s Response (Paper 30), and an Opposition to Encap’s Motion to Amend Claims (Paper 33). Encap then filed a Corrected Reply to Scotts Company’s Opposition to Encap’s Motion to Amend Claims. Paper 49.

Additionally, Scotts Company filed a Motion to Exclude Evidence (Paper 52), to which Encap responded (Paper 64) and submitted supplemental evidence (Paper 58). Scotts Company filed a Reply in further support of its Motion to Exclude. Paper 68.

Encap also filed a Motion to Exclude Evidence (Paper 54) to which Scotts Company responded (Paper 60). Encap, with authorization (Paper 70), filed a Supplement to its Motion to Exclude (Paper 66), as well as a Reply (Paper 67).

Oral hearing was held on January 30, 2014.²

The Board has jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

Scotts Company has shown by a preponderance of the evidence that claims 1-5, 7-11, 13, and 14 of the '259 patent are unpatentable. Encap's Motion to Amend Claims is denied.

A. The '259 Patent

The '259 patent is directed to a combination seed capsule, comprising at least one viable seed, a coating of a composition comprising a soil conditioning material mounted proximate and disposed outwardly of the outer surface of the seed, and optionally including one or more of inorganic chemical fertilizers, growth enhancer, binder, and/or an anti-fungal agent. Ex. 1001, Abstract, 4:5-11. According to the '259 patent Specification, the primary object of the invention is to "provide solid plant seed capsule products that supply both soil conditioning properties and the seed, which can benefit from such conditioned soil, in a given seed capsule particle." *Id.* at 3:28-31.

B. Illustrative Claim

Claims 1 and 7 are the only independent claims in the '259 patent, and are directed to a "[a] combination seed capsule." The only difference between these claims is that claim 7 additionally states that the seed coating is applied by an agglomeration process. The remaining challenged claims depend from either claim 1 or 7. Claim 1 is illustrative of the claimed subject matter, and is reproduced below.

² A transcript of the oral hearing is included in the record as Paper 78.

1. A combination seed capsule comprising:
 - one viable seed;
 - said seed acting as a core or pseudo core of said combination seed capsule;
 - a coating of a composition comprising soil conditioning materials;
 - said soil conditioning materials being in a solid state at time of coating.

C. Prior Art Supporting the Instituted Challenges

Name	Reference	Issue or Publication	Exhibit
Schreiber	U.S. Patent No. 3,698,133	Oct. 17, 1972	Ex. 1002
Roth	U.S. Patent No. 4,065,287	Dec. 27, 1977	Ex. 1003
Lowe	U.S. Patent No. 5,019,564	May 28, 1991	Ex. 1004
Matthews	GB670,461	Apr. 16, 1952	Ex. 1007

D. The Instituted Challenges of Unpatentability

References	Grounds	Claims
Schreiber	§ 102(b)	Claims 1, 7, and 13
Schreiber and Roth	§ 103(a)	Claims 2, 5, 8, 11, and 14
Schreiber and Lowe	§ 103(a)	Claims 3, 4, 9, and 10
Matthews	§ 102(b)	Claims 1, 2, 7, 8, 13, and 14
Roth	§ 102(b)	Claims 1, 2, 5, 7, 8, 11, 13, and 14
Roth and Lowe	§ 103(a)	Claims 1-5, 7-11, 13, and 14

II. DISCUSSION

A. Evidentiary Matters

1. *Scotts Company's Reply (Paper 30)*

In a conference call held on December 3, 2013, Encap asserted that Scotts Company had raised new arguments and evidence in its Reply to Patent Owner's Response to Decision to Institute. Order (Paper 37), 2. The Board denied Encap's request to file a surreply, or to enlarge the page limit of Encap's Reply in support of its Motion to Amend. *Id.* We indicated, however, that we would determine whether Scotts Company's Reply and supporting evidence contain material exceeding the proper scope of a reply. *Id.*

We find that Scotts Company's Reply, and in particular, the supporting Declarations of Mr. Fredrick Sundstrom (Ex. 1039) and Mr. Krishna Pagilla (Ex. 1040) contain material outside the proper scope of a reply. 37 C.F.R. § 42.23(b) (reply is limited to arguments raised in Patent Owner's Response). Specifically, both Declarations contain materials in support of Scotts Company's Petition, and therefore, untimely filed. For example, Mr. Sundstrom includes analyses of claim construction (e.g., Ex. 1039 ¶¶ 7-9), as well as analyses of the Schreiber (e.g., *id.* at ¶¶ 10-13), Matthews (e.g., *id.* at ¶¶ 28, 29), Roth (e.g., *id.* at ¶ 34), Simmons (*id.* at ¶¶ 36, 38), and Evans (*id.* at ¶¶ 43, 44, 46, 48) references. Likewise, Mr. Pagilla addresses claim construction, as well as the references upon which Scotts Company sought institution. *See, e.g.*, Ex. 1040 ¶¶ 9-13, 23-27, 32, 33, 36-38. Specifically, we hold that the new evidence could have been included with the motion. By waiting to serve this evidence on Encap in Scotts Company's Reply, Encap was denied the opportunity to file responsive evidence. Thus, we

have not considered the untimely Declarations of Mr. Sundstrom and Mr. Pagilla, nor the arguments based thereon.³

2. *Scotts Company's Motion to Exclude*

Scotts Company filed a Motion to exclude: portions of the deposition testimony of Mr. Michael Krysiak taken by Encap on November 6, 2013 (Ex. 2002) and December 23, 2013 (Ex. 1038); and the Second Krysiak Declaration, which includes Attachments A and B (Ex. 2016). Pet. Mot. Excl. (Paper 52), 1. Mr. Krysiak, Encap's witness, submitted a second Declaration (Ex. 2012) in support of its Reply to Petitioner's Opposition to Encap's Motion to Amend (Paper 49). Encap responded to Scotts Company's Motion to Exclude and filed supplemental evidence. PO Resp. Mot. Excl. (Paper 64); PO Supp. Evid. (Paper 58), respectively. Scotts Company filed a Reply. Paper 68. We grant-in-part Scotts Company's Motion to Exclude Evidence.

Scotts Company asserts that Mr. Krysiak's deposition testimony in response to two questions (i.e., Ex. 2002, 207, l. 9; Ex. 1038, 209, ll. 7-8) should be excluded. Pet. Mot. Excl. 9-10. As we did not rely upon this deposition testimony that Scotts Company seeks to exclude, Scotts Company's Motion is moot with respect to such testimony.

Scotts Company also moves to exclude the Second Declaration of Mr. Krysiak (Ex. 2012). Scotts Company's primary objection is that the Declaration is untimely, as it should have been submitted with Encap's Motion to

³ The fact that two declarations may contain some material appropriate for a response does not require our consideration of them, as the Board will not attempt to sort the proper from the improper portions. *See Office Patent Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012).

Amend (Paper 47). Pet. Mot. Excl., 11-14; *see* 37 C.F.R. § 42.23(b) (“All arguments for the relief requested in a motion must be made in the motion. A reply may only respond to arguments raised in the corresponding opposition or patent owner response.”). In support of Scotts Company’s Opposition to Encap’s Motion to Amend (Paper 33), it relied upon the Declaration of Mr. Sundstrom (Ex. 1039), which was not considered, as discussed above. Encap asserts that Mr. Krysiak’s Second Declaration is in rebuttal to Declarations and deposition testimony of Mr. Sundstrom and Mr. Pagilla. PO Resp. Mot. Excl. 10-11. Encap proffers supplemental evidence—a revised Second Declaration of Mr. Krysiak with citations to the Declaration and deposition of Mr. Sundstrom. Paper 58; Ex. 2016.

Reading Mr. Krysiak’s Second Declaration, it is clear that the majority of the Declaration is in support of Encap’s Motion to Amend rather than in rebuttal to Scotts Company’s Opposition to Encap’s Motion to Amend or the Declarations and deposition testimony⁴ of Mr. Sundstrom and Mr. Pagilla, and is thus, untimely. For example, paragraphs 2-3 relate to written description and claim construction, which Encap has the burden of proving in its Motion to Amend. Additionally, paragraphs 6-12 describe the background of the technology, which could have been submitted with Encap’s Motion to Amend opening brief, and thus, are not in rebuttal to testimony from Mr. Sundstrom or Mr. Pagilla. Likewise, paragraphs 25-53 and Schedule A attempt to distinguish over Matthews and Schreiber, which Encap should have done in Patent Owner’s Motion to Amend. Furthermore, to the extent that portions of Mr. Krysiak’s Second Declaration are in response to the

⁴ While not addressed, we do not suggest that filing a declaration in rebuttal to deposition testimony is appropriate.

Declarations of Mr. Sundstrom and Mr. Pagilla, which were excluded, they should likewise be excluded. Those errors were not corrected in the Supplemental Evidence (i.e., Ex. 2016) submitted by Encap.

In addition, Encap attempts to incorporate Mr. Krysiak's Second Declaration into its Reply to Scott's Opposition to the Motion to Amend by merely stating, "The proposed claims define over the prior art succinctly. *Id.* [Mr. Krysiak's Second Declaration] at ¶¶ 14-53." Reply Mot. Amend 5. In our Order of August 27, 2013, we admonished Encap to refrain from attempting to use an expert declaration in such fashion. We stated, "Encap's motion to amend may be supported by an expert declaration, but that the motion itself should set forth the arguments and explanations with appropriate pinpoint citations to the expert declaration, rather than incorporating by reference the expert declaration." Paper 17, 2-3. Thus, Scotts Company's Motion to Exclude Mr. Krysiak's Second Declaration (Ex. 2012) is granted, as Mr. Krysiak's Corrected Second Declaration (Ex. 2016) did not remedy the issues, it is not considered.

3. *Encap's Motion to Exclude*

Encap moves to exclude the Declaration of Mr. Sundstrom (Ex. 2014), Scott Company's witness who provided a declaration in support of Scott Company's Reply to Patent Owner's Response to Decision to Institute (Paper 30), on the basis that the declarant refused to answer certain questions during his deposition on the basis of confidentiality, even though a protective order was in place. PO Mot. Excl. (Paper 54), 5. Having found that Mr. Sundstrom's Declaration was untimely submitted, and thus, not considered, Encap's Motion to Exclude is dismissed as moot.

B. Claim Construction

Consistent with the statute and the legislative history of the AIA, the Board interprets claims by applying the broadest reasonable construction in the context of the specification in which the claims reside. 37 C.F.R. § 42.100(b); *see Office Patent Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012). Claim terms also are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

Two exceptions to the general rule that a claim term is given its ordinary meaning are: 1) when a patentee sets out a definition and acts as his own lexicographer; or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Id.*

1. "soil conditioning materials"

All of the challenged claims require "a coating of a composition comprising soil conditioning materials." The '259 patent Specification states that "*all soil conditioning materials contemplated herein* beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients." Ex. 1001, col. 8, ll. 41-44 (emphasis added). The Specification further provides specific examples of soil conditioning materials, such as municipal or other sewage sludge, paper mill sludge, fly ash, and dust. *Id.* at col. 7, ll. 21-23. Accordingly, in the Decision to Institute, the Board construed "soil conditioning materials" as "materials that beneficially modify soil

to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients, including for example, municipal or other sewage sludge, paper mill sludge, fly ash, and dust.” Dec. 6-7.

Although Scotts Company agrees with the Board’s preliminary construction (Pet. Reply, 1-2), Encap asserts the construction is overly broad in view of the Specification (PO Resp., 8-9). Specifically, Encap asserts the construction should be amended to include that the soil conditioner not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated irrespective of the general tilth condition of the growth medium. *Id.* (citing Ex. 1001, col. 8, ll. 42-52,⁵ Abstract). Encap does not assert that its construction is the plain and ordinary meaning of “soil conditioning materials,” but rather, that the Specification defines the phrase. PO Resp. at 8. Specifically, Encap asserts the following portion of the Specification defines “soil conditioning materials:”

However, all soil conditioning materials contemplated herein beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the seed, this invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

Ex. 1001, col. 8, ll. 42-52.

Through the inclusion of “all soil conditioning materials contemplated herein,” the first sentence requires the soil conditioning material to beneficially

⁵ Encap mistakenly refers to col. 15, l. 29–col. 16, l. 6.

modify the soil in some way, other than directly providing plant nutrients. The second sentence is an observation of benefits provided by “this invention;” it does not *require* the invention provide the observed benefits; much less require *just* the soil conditioning material of the invention provide such benefits.

Encap relies upon its experts, Mr. John Katers, Mr. Daniel Madigan, and Mr. Michael Krysiak, all of whom provide identical claim constructions, in support of its position. Ex. 2007 ¶ 11; Ex. 1020 ¶ 10; Ex. 1022 ¶ 13. The experts provide, however, no credible analysis in support of their claim constructions, and thus, are unpersuasive.

Encap asserts also that the examples included in the Board’s preliminary claim construction should be omitted, because not *all* municipal or other sewage sludge, paper mill sludge, fly ash, or dust, necessarily modify the soil in a beneficial manner. PO Resp. 9. The Board’s preliminary construction, however, requires the soil conditioning materials “modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients.” The inclusion of the examples is intended to clarify, not modify, this requirement.

Accordingly, the Board maintains its construction of “soil conditioning materials” as:

Materials that beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients, including for example, municipal or other sewage sludge, paper mill sludge, fly ash, and dust.

2. “combination seed capsule”

The phrase “combination seed capsule” appears in the preamble of claims 1 and 7. Encap asserts that the Abstract of the ’259 patent defines “combination seed capsule.” PO Resp. 10-11. The Abstract reads:

This invention pertains to combination seed capsules wherein each seed capsule includes both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent. The combination seed capsules are made by physically combining the respective soil conditioner and seed with one other, in the absence of any requirement for chemical reactions in the process of so combining the respective materials. The combination seed capsules *provide cooperative and beneficial effects of the soil conditioner and the optional inorganic fertilizer, working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed, and optionally inorganic chemical fertilizer, are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the combination seed capsule, whereby the respective materials cooperate with each other in support of germination and plant growth.*

Ex. 1001, Abstract (emphases added). Encap asserts that the text that has been italicized is the definition of a “combination seed capsule.” PO Resp. 11. Encap also relies upon its technical experts, Messrs. Baker, Madigan, and Krysiak. *Id.* at 11-12. The experts, however, provide no credible analysis in support of their claim constructions and are thus, unpersuasive.

Scotts Company asserts that the term “combination seed capsule” appears in the preamble of both independent claims (i.e., claims 1 and 7), and thus, is not limiting. Pet. Reply 2. Scotts Company also asserts that in 1998, when the application that matured into the ’259 patent was filed, the rules prohibited relying

on the Abstract “for interpreting the scope of the claims.” *Id.* at 3 (quoting 37 C.F.R. § 1.72(b)). Lastly, Scotts Company asserts that Encap is attempting to improperly import limitations into the claims. *Id.*

First, the Abstract does not provide a definition for a “combination seed capsule,” but rather observes the benefits of the combination seed capsule. Second, the preamble term “combination seed capsule” is not limiting because the claim body describes a structurally complete invention. *Catalina Mktg. Int’l v. Coolsavings.com Inc.*, 62 USPQ2d 1781, 1785 (Fed. Cir. 2002). Thus, we need not construe “combination seed capsule,” as it does not limit the claim.

3. “*being in a solid state at time of coating*”

Independent claim 1 recites, “being in a solid state at time of coating.” Similarly, independent claim 7 recites, “are in a solid state at time of coating.” Additionally, claim 7 recites, “said coating being applied to said viable seed by an agglomeration operation.” Due to the inclusion of these three limitations, claims 1 and 7 were determined to be product-by-process claims in the Decision to Institute. Dec. 7-8.

Encap asserts that “in a solid state at time of coating” should be construed as “solid material in the form of particulate, fibrous, or a suspension of a particulate or fibrous material in a liquid carrier to form an agglomeration of said particulate and/or fibers.” PO Resp. 12-13 (citing Ex. 1001, col. 8, ll. 1-5⁶). Scotts Company points out that the Specification reads, the soil conditioning raw material “*may* be a particulate powder, or *may* be fibrous, or *may* be a suspension of a powder or fibrous material in a liquid carrier, and is preferably coated onto the substrate seed

⁶ Encap erroneously cites to col. 14, ll. 24-28.

to form a seed capsule or other agglomeration of particles, fibers, *or the like*,” and thus, does not support Encap’s construction. Pet. Reply 3 (quoting Ex. 1001, col. 8, ll. 1-5 with emphasis added). We agree that the Specification does not support Encap’s proposed construction.

Encap further asserts that during prosecution of the ’259 patent application, Mr. Krysiak had discussions with the Examiner relating to “being in a solid state at the time of coating.” PO Resp. 12 (citing Ex. 1022 ¶ 15). Encap’s description of events does not provide support for its proposed claim construction. That is, it does not follow that adding the limitation to overcome Roth, defines the limitation to require “solid material in the form of particulate, fibrous, or a suspension of a particulate or fibrous material in a liquid carrier to form an agglomeration of said particulate and/or fibers.” As before, Mr. Krysiak’s opinion as to how the phrase should be construed includes no analysis, and thus, is unpersuasive.

Encap does establish that it disavowed claim scope, however, by adding the limitation “in a solid state at time of coating” to overcome Roth. That clear and unambiguous disavowal of claim scope causes us to modify the claim construction from that set forth in the Decision to Institute. Specifically, Encap narrowed the “in a solid state at time of coating” limitation to require the soil conditioning material be in a solid state at the time of coating the seed. Encap did not narrow “in a solid state at time of coating,” however, to further require a particulate, fibrous, or a suspension of a particulate or fibrous material in a liquid carrier to form an agglomeration of said particulate and/or fibers, as suggested by Encap.

The Federal Circuit has addressed the issue of determining whether a claim has been narrowed in the related context of prosecution history estoppel.

In order to give due deference to public notice considerations under the *Warner–Jenkinson* framework, a patent holder seeking to establish

the reason for an amendment must base his arguments solely upon the public record of the patent's prosecution, i.e., the patent's prosecution history. To hold otherwise—that is, to allow a patent holder to rely on evidence not in the public record to establish a reason for an amendment—would undermine the public notice function of the patent record.

Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558, 586 (Fed. Cir. 2000), *vacated on other grounds*, 535 U.S. 722 (2002).

An examination of the prosecution history of record reveals the following events which support our determination that Encap clearly disavowed the full scope of claims 1 and 7. On May 10, 2000, the Examiner issued a rejection to claim 77 as anticipated by Roth, and further rejected claims 77 and 85 as being obvious in view of Roth in combination with two other references. Ex. 1008, 171, 175.⁷ On August 8, 2000, the Examiner issued an interview summary, which indicates that a proposed claim amendment was discussed. Specifically, the Examiner stated that adding, “wherein said soil conditioning material, when added to the seed, are in a dry, solid form,” to the claims would overcome Roth. The Examiner suggested “that the claims be written in a product by process form to clearly distinguish over Roth.” *Id.* at 203. On September 8, 2000, the Examiner issued an Interview Summary indicating that claims 77 and 85 were discussed, and that “[b]ased on the proposed draft amendment and arguments recited therein, the prior art was overcome.” *Id.* at 204. The record clearly shows that the only amendment made to claim 77 was the addition of the limitation, “said soil conditioning materials being in a solid state at time of coating.” *Id.* at 200. Claim 85 was amended in similar fashion to recite, “wherein said soil conditioning

⁷ Claims 77 and 85, ultimately issued as claims 1 and 7, respectively.

materials are in a solid state at time of coating.” *Id.* at 201. Claims 77 and 85 ultimately issued as claims 1 and 7, respectively.

Thus, Encap successfully overcame Roth by adding the “in a solid state at the time of coating” limitation to claims 1 and 7. Construing the phrase as a product-by-process limitation would not result in distinguishing over Roth, as no discussion was had, nor evidence provided, to suggest the end product of Roth had different characteristics than the claimed composition. The disavowal of claim scope is clear. The limitation “in a product by process form,” therefore, must be construed to require the soil conditioning material be in a solid state at the time of coating. *See Tempo Lighting, Inc. v. Tivoli, LLC*, 742 F.3d 973, 978 (Fed. Cir. 2014).

Furthermore, Roth discloses a spray application of a MAS material that contains 0.1% to 2.5% solids at the time of coating. Ex. 1003, col. 3, ll. 50-51. Thus, the limitation “in a solid state at the time of coating” must further be construed to require more than 2.5% solids. Therefore, we construe “in a solid state at the time of coating” to mean that more than 2.5% of the soil conditioning material must be in a solid state at the time of coating the seed.

4. “*agglomeration operation*”

Independent claim 7 requires an “agglomeration operation,” which we construed in our Decision to Institute to be a product-by-process limitation. Dec. 8. Patent Owner concedes that claim 7 is a product-by-process claim. PO Resp. 16. Patent Owner, however, takes issue with the Board’s “holding” that an agglomeration operation means using water and heat to bind a plurality of particles. *Id.* at 13.

We did not construe “agglomeration operation,” other than to note that it is a product-by-process limitation. *In re Thorpe*, 777 F.2d 695, 698 (Fed. Cir. 1985). The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art. *See, e.g., In re Garnero*, 412 F.2d 276, 279 (CCPA 1969). That is especially true where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. *Id.* Thus, the issue is not focused on what “agglomeration operation” means, but rather on what properties would be embodied in a product made by an agglomeration operation (i.e., an agglomerate). Here, the parties are in near agreement on the properties of an agglomerate.

Encap states that an agglomerate is an assemblage of particles adhering to each other, and thus, a magnified image of an agglomerate would reveal that the product is comprised of particulate. PO Resp. 13-16. Without credible explanation, Encap in its conclusion limits its final description of an agglomerate to an assemblage of *fine* particles. *Id.* at 16. Evidence cited by Encap that may support this additional limitation is an article by Wolfgang B. Pietsch, titled “The Agglomerative Behavior of Fine Particles.” *Id.* at 13-14 (citing Ex. 1020 ¶ 11, Attachment A). As the title suggests, however, the article is specifically directed to agglomerates of fine particles. There is no credible suggestion in Mr. Madigan’s Declaration (Ex. 1020) that an “agglomerate” is limited to fine particles. *See* Ex. 1020 ¶¶ 11-17.

Scotts Company appears to accept Encap’s description of an agglomerate, but takes exception, as we do, with the limitation to fine particles. Pet. Reply 3-4.

Thus, we determine that an agglomerate is an assemblage of particles adhering to each other. The “agglomeration operation” limitation of claim 7 implies that the claimed “combination seed capsule” has a coating of a composition comprising soil conditioning materials comprised of particulate. As such, to satisfy the limitation of an “agglomeration operation,” a reference must disclose a product with the structural limitation of being comprised of particulate, irrespective of the process used to make the product.

C. Anticipation by Roth—Claims 1, 2, 5, 7, 8, 11, 13, and 14

Roth explains that the MAS coating is “solid” after application. Roth, however, does not disclose the soil conditioning materials “being in a solid state at time of coating,” because Roth discloses a spray application of a MAS material that is 97.5% to 99.9% liquid with the remainder “solids content.” PO Resp. 31-32 (citing Ex. 1003, col. 3, ll. 50-51). While a tiny amount (i.e., 0.1% to 2.5%) of the soil conditioning material is in solid state at the time of coating, as discussed above, this is not enough to satisfy the limitation “in a solid state at time of coating,” recited in claims 1 and 7. As such, Scotts Company has not shown, by a preponderance of the evidence, that Roth anticipates 1, 2, 5, 7, 8, 11, 13, and 14.

D. Obviousness over Roth and Lowe—Claims 1-5, 7-11, 13, and 14

Roth teaches the claimed “seed acting as a core or pseudo core” with a “coating of a composition comprising soil conditioning materials,” as required by claims 1 and 7. Specifically, Roth describes coating seeds with a methanol treated “sludge” carrier having one or more agricultural chemicals dispersed therein, wherein the source material is “municipal sewage,” as required by dependent claims 2, 5, 8, and 11. *See, e.g.*, Ex. 1003, col. 3, ll. 23-26. Roth also discloses that its coating may include a “binder,” e.g., polyvinyl alcohol, starch derivatives,

and further may include a fertilizer, as recited in claims 13 and 14. *Id.* at col. 2, ll. 3-5, 48-51; col. 5, ll. 49-52. Thus, we determine that Roth discloses all the limitations of claims 1, 2, 5, 7, 8, 11, 13, and 14 with the exception of “in a solid state at time of coating,” as required by independent claims 1 and 7.

Lowe discloses coating a seed with de-inked paper sludge having a “fiber content of the solids in the mixture should exceed at least 10%-15% by weight,” thereby teaching “in a solid state at time of coating.” Ex. 1004, col. 3, ll. 17-21. Lowe also discloses using “agglomeration” to combine the fibers to form individual granules. *Id.* at Abstract; col. 3, ll. 21-22. Thus, as discussed in greater detail below, Lowe in combination with Roth satisfies the limitations of independent claims 1 and 7 as the combination involves the use of known components for their known purpose to achieve a predictable result.

Lowe further teaches coating a seed with a material that is a byproduct of a “paper making process,” and specifically that the byproduct is “paper sludge,” as required by dependent claims 3, 4, 9, and 10. Lowe describes an agricultural granule for carrying and releasing agricultural chemicals that resembles a clay-based granule. *Id.* at Abstract. The agricultural granule is made from using waste materials from paper manufacture, referred to as paper sludge. *Id.* at col. 1, l. 68–col. 2, l. 1; col. 2, ll. 40-44.

Scotts Company asserts that because Roth teaches a MAS carrier for agricultural chemicals that can coat a seed, and because Lowe likewise teaches an agricultural carrier consisting of paper sludge, a person of ordinary skill in the art would have had reason to substitute Lowe’s paper mill sludge for Roth’s MAS coating. Pet. 57.

Encap asserts that the proposed combination runs contrary to the disclosure of Roth. PO Resp. 43. In particular, Encap asserts that Lowe requires the fiber content of the finished particle be above 10%, which means, therefore, that the material is 90% or less filler. *Id.* (citing Ex. 1004, col. 4, ll. 65-66; col. 6, ll. 53-63). On the other hand, Roth discloses MAS that is 97.5%-99.9% liquid. *Id.* (citing Ex. 1003, col. 3, ll. 50-51). Encap asserts that a product that is 97.5% or more liquid could not be replaced by a product with 10% or more fiber content and still be sprayed. *Id.* (citing Ex. 1020 ¶ 22). We do not find Encap's argument persuasive because Roth is not limited to spray-on coatings. The MAS, and presumably Lowe's paper sludge, can be applied to the seeds "by dipping, soaking, spraying, or other conventional mode of application." Ex. 1003, col. 4, ll. 48-50.

Encap also asserts that Roth's disclosure of a coating with 0.1% to 2.5% solids teaches away from using Lowe's coating containing over 10% solids. PO Resp. 43. Roth, however, "does not criticize, discredit, or otherwise discourage" the use of a higher percentage of solids. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Thus, Encap's argument is not persuasive.

Encap further asserts that paper sludge and MAS have very different characteristics. PO Resp. 44-45. In particular, Encap asserts that attempting to coat a seed with paper sludge, using the agglomeration process disclosed in Lowe, would not have a reasonable likelihood of success. *Id.* at 46. In support of its assertion, Encap submits the Declaration of Mr. Madigan (Ex. 1020) who testifies as to the difficulties associated with coating seeds with paper sludge utilizing the agglomeration process of Lowe. *Id.* We do not credit Mr. Madigan's declaration as it fails to provide the underlying basis for his conclusions. For example, Mr. Madigan cites an attachment that purports to show what a final product of Lowe

would look like if seed is introduced into the agglomeration process of Lowe. Ex. 1020, ¶ 23 and Attachment 5. Mr. Madigan, however, does not provide sufficient details regarding the underlying testing upon which he appears to rely. 37 C.F.R. § 42.65. Further, Scotts Company combined the paper sludge of Lowe (not its agglomeration process) with Roth. *See, e.g.,* Pet. 57.

As to Encap's assertion that Roth in view of Lowe does not disclose a "combination seed capsule," as discussed above, the preamble recitation "combination seed capsule" is not an additional structural limitation on the claim. PO Resp. 47.

Lastly, Encap asserts that Lowe's paper sludge is not a "soil conditioning material." *Id.* (citing Ex. 2007 ¶ 19). Paragraph 19 of Mr. Katers' Declaration, however, does not support Encap's contention. Mr. Katers merely states that "[n]ot all paper sludge material would benefit the soil to which it is applied;" he does not state that Lowe's paper sludge is not beneficial to the soil. Ex. 2007 ¶ 19.

We, therefore, conclude that the ordinary artisan would have combined Roth and Lowe to arrive at the claimed composition.

E. Anticipation by Schreiber—Claims 1, 7, and 13

Schreiber discloses the limitations of claims 1 and 7. For example, Schreiber discloses a plant seed having multiple coatings thereon, which satisfies the claimed "seed acting as a core or pseudo core." Ex. 1002, col. 1, ll. 4-6; col. 9, ll. 38-43. Schreiber further discloses the claimed "coating of a composition comprising soil conditioning materials." Specifically, Schreiber describes a seed coating made of a composition comprising solid particulate coating material, such as ground peat moss, thereby satisfying the claimed "being in a solid state at time of coating," of claims 1 and 7. *Id.* at col. 2, ll. 34-49; col. 10, ll. 40-42. Schreiber

explains that its invention permits the tailoring of seed coatings for achieving optimum germination and growth, while allowing early planting within a wide time period. Schreiber also explains that other advantages also accrue from the invention. Schreiber, thus, satisfies our construction of “soil conditioning materials” because its coating provides better root development and drought resistance. *Id.* at col. 2, ll. 15-19; col. 9, ll. 44-49. Schreiber also discloses that the coating is an “agglomeration” of a plurality of types of materials, as Schreiber explains that the coating composition includes a “binder,” required by claim 13, or a plasticizer, and that the coating layers may coalesce, thereby satisfying the agglomeration requirement of claim 7. *Id.* at col. 2, ll. 37-39, 55-56; col. 3, ll. 35-42; col. 6, ll. 23-32.

Encap asserts that Schreiber does not disclose a “combination seed capsule.” PO Resp. 18-23. For the reasons discussed above, a “combination seed capsule” found in the preamble of claims 1 and 7 does not further limit the claim. Encap also asserts that Schreiber does not disclose a “soil conditioning material.” *Id.* at 23-26. Schreiber, however, discloses peat moss, limestone, gypsum, and vermiculite. Ex. 1002, col. 2, ll. 44-49. Those materials are known to beneficially modify the soil in some way other than direct provision of plant nutrients, and are, thus, “soil conditioning materials,” as recited in claims 1 and 7. *See, e.g.*, Exs. 1028-1031. Encap’s expert, Mr. Baker, acknowledged that peat moss, limestone, gypsum, and vermiculite are all soil conditioning materials. Baker Depo., Ex. 2005, 88, l. 22– 90, l. 9.⁸

⁸ We reference page numbers found in the lower right corner of the exhibit.

Encap seeks to distinguish Schreiber on a purported difference in the function of the Schreiber coating and those disclosed in the '259 patent. Specifically, Encap asserts that Schreiber discloses using a water-insoluble coating with a water-soluble binder (e.g., peat moss) to delay germination until growing conditions are favorable, whereas, the soil conditioning materials of the '259 patent enhance germination and plant growth. PO Resp. 25. For the reasons already discussed, the claim limitation "soil conditioning materials" does not require the material also provide soil conditioning value to the seed. Moreover, the '259 patent explicitly discloses that the coating may be used to delay germination. Ex. 1001, col. 4, ll. 12-20; col. 25, ll. 8-17. Just because Schreiber's coating also serves to delay germination does not mean that it is not a "soil conditioning material," so long as it beneficially modifies the soil, in some way other than direct provision of plant nutrients.

In summary, we hold that Scotts Company has shown, by a preponderance of the evidence, that claims 1, 7, and 13 are anticipated by Schreiber, under 35 U.S.C. § 102(b).

F. Obviousness over Schreiber and Roth—Claims 2, 5, 8, 11, and 14⁹

As discussed above, Schreiber discloses the elements of independent claims 1 and 7. Scotts Company proposes using Roth's MAS in place of Schreiber's peat moss. Pet. 38-39. Scotts Company's proposed combination would result in a seed coated with Roth's MAS, and as discussed above, MAS does not satisfy the claim limitation that the soil conditioning material be "in a solid state at the time of coating."

⁹ In its Response, Encap references claim 15 instead of 14. We have interpreted Encap's reference as intended to be to claim 14. PO Resp. 26-27.

Therefore, we hold that Scotts Company has not shown, by a preponderance of the evidence, that claims 2, 5, 8, 11, and 14 are unpatentable over Schreiber and Roth, under 35 U.S.C. § 103(a).

G. Obviousness over Schreiber and Lowe—Claims 3, 4, 9, and 10

As discussed above, Schreiber discloses the elements of independent claims 1 and 7. Lowe further teaches a material that is a byproduct of a “paper making process,” and specifically that the byproduct is “paper sludge” as required by dependent claims 3, 4, 9, and 10. Lowe describes an agricultural granule for carrying and releasing agricultural chemicals that resembles a clay-based granule. Ex. 1004, Abstract. The agricultural granule is made from using waste materials from paper manufacture, referred to as paper sludge. *Id.* at col. 1, l. 68–col. 2, ll. 1, 40-44. Scotts Company asserts that because Lowe teaches an agricultural granule made from paper sludge for carrying and releasing incorporated agricultural chemicals that resembles a clay-based granule (*id.* at Abstract; col. 2, l. 1), a person of ordinary skill would have had reason to substitute Schreiber’s water-insoluble, solid, clay-like, agricultural inner coating material with Lowe’s paper sludge materials. Pet. 40.

Schreiber discloses that its inner coating controls permeability of water and is typically water insoluble. Ex. 1002, col. 2, ll. 34-39. Encap asserts that there is no evidence that Lowe’s material, derived from paper sludge, would operate to control water permeability (i.e., is water insoluble)—a trait important to the teachings of Schreiber. PO Resp. 28. Scotts Company does not respond to Encap’s argument, and fails to provide any evidence that Lowe’s agricultural granule is water insoluble. If Lowe’s material is water soluble, it would not be a

suitable replacement for Schreiber's inner coating, as it would frustrate Schreiber's objective of delayed germination.

In summary, we hold that Scotts Company has failed to show, by a preponderance of the evidence, that claims 3, 4, 9, and 10 are unpatentable over Schreiber and Lowe under 35 U.S.C. § 103(a).

H. Anticipation by Matthews—Claims 1, 2, 7, 8, 13, and 14

Matthews discloses the claimed "seed acting as a core or pseudo core" with a "solid" "coating of a composition comprising soil condition materials," as required by claims 1 and 7. Ex. 1007, 2, ll. 41-89. Specifically, Matthews describes a seed pellet product coated with "fly ash," as required by dependent claims 2 and 8. *Id.* at 2, ll. 10-12, 61-64. Matthews further describes alternately spraying and dusting the seed with the coating until the desired thickness is reached, after which the seed pellets are dried. *Id.* at 2, ll. 81-84, 88-89. Matthews also discloses that the coating is an "agglomeration" of a plurality of types of materials, as required by claim 7, because Matthews explains that the coating of dust particles is bound by an adhesive water-soluble plastic, such as polyvinyl alcohol or methyl cellulose, around and about the original seed particle. *Id.* at 2, ll. 42-45, 50-54; 3, ll. 5-9. Matthews describes applying a "binder," as required by dependent claim 13, to the seed capsule, e.g., polyvinyl alcohol, to hold the coating substances firmly on the seed. *Id.* at 2, ll. 42-45; 3, ll. 5-9. Further, the Matthews seed coating may include "fertilizer," thus satisfying dependent claim 14. *Id.* at 5, ll. 25-27.

Encap asserts that Matthews does not disclose a "combination seed capsule." PO Resp. 38. As discussed above, the preamble recitation "combination seed capsule" does not further limit the claim. In addition, Encap unpersuasively asserts

IPR2013-00110
Patent 6,209,259

that Matthews' fly ash may not be necessarily beneficial to the seed (*id.*)—a requirement lacking from our claim construction of “soil conditioning material.” Relying upon Messrs. Baker and Katers, Encap asserts that Matthews' fly ash does not *necessarily* modify the soil in a beneficial manner, and hence, has not been proved to be a soil conditioning material. *Id.* at 39-42 (citing Ex. 2011 ¶ 21; Ex. 2007 ¶ 24). Essentially, Encap's argument is that while fly ash is specifically identified in the '259 patent as a soil conditioning material (*see, e.g.*, Ex. 1001, col. 7, ll. 21-25), not *all* fly ash is suitable—indeed, some types of fly ash are toxic. *Id.* Matthews, however, states that “[e]ach material must be stable and non-toxic.” Ex. 1007, 8, ll. 9-10. Moreover, Mr. Baker also acknowledged that a person of ordinary skill would have understood that a non-toxic fly ash could be used to coat a seed as a soil condition material, and that using toxic materials harmful to the seed should be avoided. Ex. 2005, 150, l. 18–151, l. 20. Lastly, Matthews also discloses that the use of its coating materials “aid in germination” and “growth of the plant.” Ex. 1007, 2, ll. 33-39. Thus, we determine that a person of ordinary skill would interpret Matthews as using non-toxic fly ash, beneficial to the soil.

Matthews also discloses using lime (*id.* at 5, ll. 28-35), which Mr. Krysiak admitted was a soil condition material (Ex. 2002, 148, ll. 18-23).

Therefore, we hold that Scotts Company has shown, by a preponderance of the evidence, that claims 1, 2, 7, 8, 13, and 14 are anticipated by Matthews under 35 U.S.C. § 102(b).

I. Secondary Considerations

Before we can determine that the combination of Roth and Lowe (*see* Section D, above), renders the challenged claims unpatentable as obvious, we must consider the evidence of obviousness anew in light of any evidence of secondary

considerations of nonobviousness presented by Encap. *See Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966) (“Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.”); *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) (“This objective evidence must be ‘considered as part of all the evidence, not just when the decisionmaker remains in doubt after reviewing the art.’”) (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538-39 (Fed. Cir. 1983)).

Encap alleges copying by others, long felt need, and commercial success as secondary considerations of non-obviousness. PO Resp. 48-49. Encap, however, fails to provide sufficient credible evidence to support its allegations.

Encap alleges that Scotts Company’s Miracle-Gro[®] Turf Builder Grass Seed with Water Smart[®] is a copy of the product of the ’259 patent. *Id.* at 48. To support its allegations, Encap submits a copy of marketing brochures for EncapSeed[™] products (Ex. 1009, 89-97), a copy of the packaging from Scotts Company’s Turf Builder Grass Seed with Water Smart[®] (*id.* at 98-101; Ex. 2013, 342-43, 346-47), a copy of a website print out pertaining to Scotts Company’s TurfBuilder (Ex. 2013, 344-45), a Declaration by Mr. Krysiak dated October 31, 2012 and submitted during an *ex parte* reexamination (Ex. 1009, 118-131), and a Declaration by Mr. Krysiak (Ex. 1022 ¶¶ 41, 42). None of the evidence submitted by Encap, however, demonstrates that Scotts Company’s Miracle-Gro[®] Turf Builder Grass Seed with Water Smart[®] product falls within the scope of any claim of the ’259 patent, that Scotts Company was aware of the ’259 patent prior to

developing its product, or that Scotts Company developed its product by copying the '259 patent.

Encap also asserts that there was a long-felt need for invention disclosed in the '259 patent. PO Resp. 48-49. Specifically, Encap asserts that many homeowners could not get their grass seed to grow because of inappropriate watering. *Id.* at 48. Encap, however, presents no credible evidence this need was satisfied by the '259 patented invention.

Lastly, Encap asserts commercial success because Meadowland took a license to the '259 patent. *Id.* at 49. Encap, however, does not allege that Meadowland's licensed product was commercially successful, or that any such commercial success was attributable to the patented features of the product. Encap also asserts that Scotts Company's product was commercially successful. *Id.* Encap, however, does not provide persuasive evidence that Scotts Company's product is covered by any claim of the '259 patent, that such product was commercially successful, or that such success was attributable to the patented feature.

After weighing all the evidence of obviousness and nonobviousness of record, on balance, we conclude that the strong evidence of obviousness outweighs the weak evidence of nonobviousness. For the foregoing reasons, we conclude that Scotts Company has shown, by a preponderance of the evidence, that claims 1-5, 7-11, 13, and 14 are unpatentable under 35 U.S.C. § 103(a) over Roth and Lowe.

J. Encap's Corrected Motion to Amend Claims

Encap filed a Motion to Amend Claims (Paper 24), which was later corrected (Paper 47) ("Mot."). In the Corrected Motion, Encap proposes substitute

claims 15-24, to replace claims 2-5, 8-11, 13, and 14,¹⁰ respectively. Mot. 1. The Corrected Motion is contingent, meaning that a proposed substitute claim is at issue and would be considered only if “the original claims of the ’259 patent are found unpatentable.” *Id.* While somewhat ambiguous, we interpret Encap’s motion as proposing a substitute claim if the claim it replaces is found unpatentable, as opposed to being contingent on all of the challenged claims being found unpatentable. Scotts Company has demonstrated the unpatentability of claims 1-5, 7-11, 13, and 14. Therefore, the contingency has materialized, and thus, we consider the Corrected Motion on the merits.

As the moving party, Encap bears the burden of proof to establish that it is entitled to the relief requested. 37 C.F.R. § 42.20(c). The proposed amendment is not entered automatically, but only upon Encap’s having demonstrated the patentability of those substitute claims. Here, we find that Encap has failed to demonstrate that the added limitations distinguish over the known prior art, for example, Roth in combination with Lowe. Hence, Encap’s Motion to Amend is denied.

In a conference call on August 26, 2013, we provided Encap guidance on filing a motion to amend the claims, and specifically directed the parties to the analysis in *Idle Free Sys. v. Bergstrom, Inc.*, IPR2012-00027, Paper 26 (PTAB June 11, 2013). The summary of the call is reflected in Paper 17 of the record. *Idle Free* holds that a patent owner should specifically identify features added to

¹⁰ Encap later identifies the substitution as claims 15-24 in place of claims 2-5 and 11-13. Mot. 2-5. Thus, it is unclear whether claims 23-24 are proposed as replacement for claims 13 and 14, or for claims 12 and 13. However, as we discuss below, the issue is moot.

each substitute claim, and come forward with technical facts and reasoning about those features, including construction of new claim terms. *Idle Free*, slip op. at 7. The patent owner should also discuss the “significance and usefulness” of the added features “from the perspective of one with ordinary skill in the art.” *Id.* We agree with the reasoning in *Idle Free*, and conclude that Encap has failed to satisfy its burden to demonstrate the patentability of the proposed substitute claims by a preponderance of the evidence.

While Encap identifies nineteen separate “structural limitations,” presumed to be new, it does not identify how each of these structural limitations differs from what is previously recited in the claims. 37 C.F.R. § 42.221(b) (“A motion to amend claims must . . . show the changes clearly . . .”). Specifically, Encap’s listing of proposed claims 15-24 does not show, by redline or discussion, how the claims being replaced have been modified. Mot. 1-5. Moreover, Encap fails to construe any new claim limitation, and also fails to proffer any technical facts and reasoning about the amended features. *Idle Free*, slip op. at 7. Encap’s failure to comply with the Board’s directive places Scotts Company in the unfair position of having to ascertain the claim amendments and then make assumptions about which of the amendments are considered by Encap to be significant. For amended claims, however, the burden “is not on the petitioner to show unpatentability;” it is “on the patent owner to show patentable distinction over the prior art.” *Id.* at 7. Encap has not met its burden.

For example, to determine the differences between original claim 2 and its proposed substitute, claim 15, the following comparison was created, with bracketed text indicating material deleted from claim 2, and underlined text indicating material inserted into claim 2 (paragraphing added).

[2] 15. The combination seed capsule of claim 1 wherein [material of said soil conditioning materials are comprised of sludge or fly ash] said combination seed capsules provides cooperative and beneficial effects of said soil conditioning material working together in controlled intimate relation with said seed, to enhance the germination and growth processes of said seed and the plant emergent therefrom, said effects being greater than when said soil conditioning material and said seed are applied to the soil separately; wherein said effects result from an intimate relationship of said soil conditioning materials in said combination seed capsule, whereby said materials cooperate with each other in support of said germination and growth processes;

said soil conditioning material is a material that beneficially modifies soil in some way other than direct provision of fertilizer, used with said seed to provide soil conditioning value to said seed so coated, irrespective of general tilth condition of the growth medium into or onto which the seed capsule is applied;

said solid state at time of coating comprising materials in form of a particulate material, fibrous material, a suspension of said particulate and/or fibrous material in a liquid suspension, or any combination thereof; said soil conditioning value of said soil conditioning material to said seed comprises the enhanced control of moisture about said seed; said enhanced control consists of absorbing and holding water;

said coating of said combination seed capsule comprises a plurality of particles.

Encap does not explain why each new feature is “significant and useful,” does not construe any of the new claim limitations, nor proffer any technical facts and reasoning about the amended features. Instead, Encap provides conclusory statements only, such as “Roth does not provide the cooperative and beneficial

effects of this structural limitation.” Mot. 6. Encap does not provide a proposed interpretation of the recited “cooperative and beneficial effects” of proposed substitute claim 15, nor does it explain whether Roth provides some of the “effects of this structural limitation,” and not others or why.

Encap asserts that the structural limitations themselves provide the technical facts and reasoning, as well as the significance and usefulness of the limitations. Pet. Reply 3. Encap asserts also that the “[c]laim construction of the structural limitations is found within the limitations themselves.” *Id.* We disagree. Providing “cooperative and beneficial effects” is vague and not self-defining, in any meaningful way. Consequently, the usefulness and significance of the limitation is not self-evident. The same can be said of, “working together in controlled intimate relation.”

Encap also fails to “provide meaningful reasons” for making additional changes to dependent claims. *Idle Free*, slip op. at 9. For example, claim 18, which depends from claim 15, adds three new limitations. *See* Mot. at 3; *see also id.* at 3-4 (claims 19 and 20 both depend from claim 17, and only differ by inclusion of a fungicide in claim 19). But Encap fails to explain why the additional features were added to these dependent claims. *Idle Free*, slip op. at 9-10 (“Adding features for no meaningful reason is . . . not responsive to an alleged ground of unpatentability.”).

In addition, *Idle Free* further instructs patent owners to consider and distinguish “prior art,” both “of record” and “not of record but known to the patent owner.” *Id.* at 7. Moreover, we specifically explained to Encap that “[a] conclusory statement that no prior art is known to the patent owner . . . is insufficient.” IPR2013-00110, Paper 17, 2. On page 1 of its Motion (Paper 47),

Encap states, “No closer art than the prior art cited in the underlying *inter partes* review is known to PO.” Encap, however, was aware of additional relevant prior art, including Simmons and Evans, which were cited in Scotts Company’s request for *inter partes* review, but which were deemed cumulative of the adopted grounds of rejection. *See* Pet. at 41-49; Prelim. Resp. at 25. While those references may have been cumulative over the original claims, they are not be cumulative in view of Encap’s proposed substitute claims, and should be addressed. Encap’s proposed claim 15 recites that the soil conditioning material “comprises enhanced control of moisture about said seed” consisting of “absorbing and holding water.” Encap distinguishes the prior art in this *inter partes* review by arguing that it does not teach enhancing moisture about the seed. Mot. at 9-10. Simmons and Evans specifically disclose coating a seed with a water-absorbable polymer. Yet, Encap failed to distinguish its proposed claims over those two material prior art references.

Encap attempts to correct some of its errors by filing an expert declaration with its Corrected Reply to Motion to Amend. Paper 49; Ex. 2012. As already addressed, however, we exclude this Declaration as untimely and improperly incorporated by reference into Encap’s Motion. In addition, as discussed above, the proffered “corrected” Second Declaration of Mr. Krysiak does not overcome Scotts Company’s objections, and is thus, excluded.

For the above reasons, Encap’s Corrected Motion to Amend Claims is denied as it fails to distinguish over the prior art, for example, Roth in combination with Lowe.

III. CONCLUSION

Scotts Company has shown by a preponderance of the evidence that:

(1) claims 1, 7, and 13 of the '259 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Schreiber; (2) claims 1, 2, 7, 8, 13, and 14 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Matthews; and (3) claims 1-5, 7-11, 13, and 14 are unpatentable under 35 U.S.C. § 103(a) as obvious over Roth and Lowe.

Scotts Company has not shown by a preponderance of the evidence that:

(1) claims 1, 2, 5, 7, 8, 11, 13, and 14 of the '259 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Roth; (2) claims 2, 5, 8, 11, and 14 are unpatentable under 35 U.S.C. § 103(a) as obvious over Schreiber and Roth; or (3) claims 3, 4, 9, and 10 are unpatentable under 35 U.S.C. § 103(a) as obvious over Schreiber and Lowe.

Encap has not shown by a preponderance of the evidence that its proposed substitute claims 15-24 are patentable over the prior art.

IV. ORDER

In consideration of the foregoing, it is hereby ORDERED that:

Scotts Company's Motion to Exclude Mr. Krysiak's Second Declaration (Ex. 2016) is granted and all other relief requested in the motion is denied;

Encap's Motion to Exclude Mr. Sundstrom's Declaration (Ex. 1039) is dismissed as moot;

Claims 1-5, 7-11, 13, and 14 of the '259 patent are determined to be unpatentable; and

Encap's Corrected Motion to Amend Claims is denied.

IPR2013-00110
Patent 6,209,259

This is a final decision. Parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2013-00110
Patent 6,209,259

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	First Named Inventor	D. Madigan
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Attorney or agent of record. Registration Number 34,751

Signature

Typed or Printed Name **Philip M. Weiss**

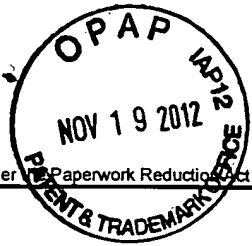
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Patent No. 6,209,259

NOTICE OF *EX PARTE* REEXAMINATION

Notice is hereby given that a request for *ex parte* reexamination of U.S. Patent No. 6,209,259 was filed on 03/09/12 under 35 U.S.C. § 302 and 37 C.F.R. § 1.510(a).

The reexamination proceeding has been assigned Control No. 90/012,183

This Notice incorporates by reference into the patent file, all papers entered into the reexamination file.

Note: This Notice should be entered into the patent file.

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Wisconsin on the following

Trademarks or Patents. (the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 11-C-685	DATE FILED 7/18/2011	U.S. DISTRICT COURT Eastern District of Wisconsin
PLAINTIFF Encap LLC		DEFENDANT The Scotts Company LLC et al
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 6,209,259	4/3/2001	ENCAP LLC
2 7,412,878	8/19/2008	ENCAP LLC
3 6,745,513	6/8/2004	ENCAP LLC
4		
5		

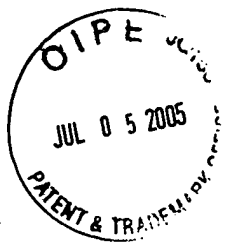
In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK JON W. SANFILIPPO	(BY) DEPUTY CLERK A. Wachtendonck	DATE 7/19/2011
----------------------------	--------------------------------------	-------------------



COMPLETED

DSD
P/35-5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Michael Krysiak
Serial No.: 09/113,254 Date: July 10, 1998
Patent No.: 6,209,259 Issued: April 3, 2001
For: SEEDING TREATMENTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

CHANGE OF CORRESPONDENCE ADDRESS

Sir:

Please amend the correspondence address for the above-identified patent application to:
Philip M. Weiss, Esq.
Weiss & Weiss
300 Old Country Road, Suite 251
Mineola, New York 11501
Telephone: (516) 739-1500
Telefax: (516) 739-2189

Applicant requests that all future correspondence be mailed to the above-address.

June 29, 2005

Respectfully submitted,
Philip M. Weiss
Philip M. Weiss
Registration No. 34,751
Attorney for Applicant
WEISS AND WEISS
300 Old Country Road, Ste. 251
Mineola, New York 11501
Telephone: (516) 739-1500
Telefax: (516) 739-2189

Certificate of Mailing Under 37 C.F.R. §1.8(a)

I hereby certify that this correspondence and any documents attached herewith is being deposited with the U.S. postal service as first class mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313 on the date indicated below.
Dated: June 29, 2005

Maureen P. Herbst
Maureen P. Herbst

**PHILIP M WEISS
 WEISS & WEISS
 500 OLD COUNTRY ROAD
 GARDEN CITY NY 11530**

**Mail Date: February 26, 2001
 Serial Number: 09/113254
 Applicant: MADIGAN**

NOTICE TO PAY BALANCE OF ISSUE FEE

Your issue fee payment filed on 12/21/00 has been received. However, new patent fees went into effect on October 1, 2000. The final rule entitled "Revision of Patent Fees for Fiscal Year 2001" was published in the *Federal Register*/Vol. 65, No. 156/Friday, August 11, 2000 [49193-49199] and in the U.S. Patent and Trademark Office *Official Gazette*, August 29, 2000 [1237 OG 131-138]. As stated in the final rule, "Any fee amount that is paid on or after the effective date of the fee increase will be subject to the new fees then in effect." The Notice of Allowance and Issue Fee Due (Form PTOL-85) that was mailed to you prior to October 1, 2000, stated an issue fee amount that was in effect prior to October 1, 2000. However, inasmuch as your issue fee was paid on or after October 1, 2000, the new issue fee amount was due.

In accordance with 37 CFR 1.317, you are given a time period of **THREE (3) MONTHS** from the mailing date of this notice during which to pay the **BALANCE DUE** indicated below. This three-month time period may not be extended. **If your patent issues before the expiration of the three-month period and if you do not pay the balance due before the expiration of the three-month period, your patent will lapse at the termination of the three-month period.**

TYPE OF ISSUE FEE PAID	Column A ISSUE FEE IN EFFECT AS OF OCT. 1, 2000 large entity / small entity	Column B ISSUE FEE PAID	BALANCE DUE [Col. A minus Col. B]
UTILITY	\$1,240.00 / \$620.00	\$ <u>605.00</u>	\$ <u>15.00</u>
DESIGN	\$440.00 / \$220.00	\$ <u> </u>	\$ <u> </u>
PLANT	\$600.0/0 / \$300.00	\$ <u> </u>	\$ <u> </u>


 Office of Patent Publication
 Tel: 703-305-8263

You MUST return a copy of this Notice with your payment.

CERTIFICATE OF MAILING

I hereby certify that this notice and the required additional fee are being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to Box ISSUE FEE, Commissioner for Patents, Washington, D.C. 20231 on the date indicated below.

Printed Name: _____ Signature: _____

Date: _____

135-5

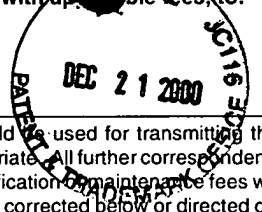
Best Available Copy ISSUE FEE TRANSMITTAL

12-22-00

JB

Complete and mail this form, together with applicable fees, to:

Box ISSUE FEE
Assistant Commissioner for Patents
Washington, D.C. 20231



EL 636894151US

VB

MAILING INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE. Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

Note: The certificate of mailing below can only be used for domestic mailings of the Issue Fee Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing.

Express Certificate of Mailing

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below.

Nelly Bronnberg (Depositor's name)
Nelly Bronnberg (Signature)
December 21, 2000 (Date)

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

HM12/0926

PHILIP M. WEISS
WEISS & WEISS
500 OLD COUNTRY ROAD
GARDEN CITY NY 11530

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
09/113,254	07/10/98	014	GRUNBERG, A	1661 09/26/00
First Named Applicant	MADIGAN,	35 USC 154(b) term ext. =	0 Days.	

TITLE OF INVENTION SEEDING TREATMENTS

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
3 29214	047-057.600	S82	UTILITY	<input checked="" type="checkbox"/> YES	\$1210.00	12/26/00

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

"Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Philip M. Weiss, Esq.

2 Weiss and Weiss PC

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
Encap, LLC

(B) RESIDENCE: (CITY & STATE OR COUNTRY)
Green Bay, WI

Please check the appropriate assignee category indicated below (will not be printed on the patent)

individual corporation or other private group entity government

4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):

Issue Fee

Advance Order - # of Copies _____

4b. The following fees or deficiency in these fees should be charged to:

DEPOSIT ACCOUNT NUMBER _____
(ENCLOSE AN EXTRA COPY OF THIS FORM)

Issue Fee

Advance Order - # of Copies _____

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above.

(Authorized Signature) Philip M. Weiss
Philip M. Weiss-RN: 34,751
(Date) 12/21/00

NOTE: The Issue Fee will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending on the needs of the individual case. Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND FEES AND THIS FORM TO: Box Issue Fee, Assistant Commissioner for Patents, Washington D.C. 20231

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

12/26/2000 MFANAEI1 00000008 09113254
01 FC:631 605.00 0P

TRANSMIT THIS FORM WITH FEE



Approved for use through 09/30/2009. PTO/SB/10 (1-99) Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

#14
CX-3
(-30-01)

**STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(e)) - SMALL BUSINESS CONCERN**

Docket Number (Optional)
P/35-5

Applicant, Patentee, or Identifier: Encap LLC
Application or Patent No.: 09/113,254
Filed or issued: July 10, 1998
Title: SEALING TREATMENTS

I hereby state that I am
 the owner of the small business concern identified below.
 an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN Encap LLC

ADDRESS OF SMALL BUSINESS CONCERN 3921 Algoma Road
Green Bay, WI 54311

I hereby state that the above identified small business concern qualifies as a small business concern as defined in 13 CFR Part 121 for purposes of paying reduced fees to the United States Patent and Trademark Office. Questions related to size standards for a small business concern may be directed to: Small Business Administration, Size Standards Staff, 409 Third Street, SW, Washington, DC 20416.

I hereby state that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

- the specification filed herewith with title as listed above.
- the application identified above.
- the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern, or organization having rights in the invention must file separate statements as to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization having any rights in the invention is listed below:
 no such person, concern, or organization exists.
 each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.29(b))

NAME OF PERSON SIGNING Michael Krysiak

TITLE OF PERSON IF OTHER THAN OWNER President

ADDRESS OF PERSON SIGNING 3921 Algoma Road, Green Bay, WI 54311

SIGNATURE Michael Krysiak DATE 12-21-00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

#15KS



P/35-5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Encap LLC.

Serial No.: 09/113,254

Filing Date: July 10, 1998

For: SEEDING TREATMENTS

Assistant Commissioner for Patents
Washington, D.C. 20231

BOX ISSUE FEE

SUBMISSION OF FORMAL DRAWINGS

Sir:

In response to the Notice of Allowability dated September 26, 2000, please find enclosed six (6) sheets of formal drawings containing Figures 1-8.

Application should now proceed to issuance.

Respectfully Submitted,

A handwritten signature in black ink that reads "Philip M. Weiss".

Philip M. Weiss, Esq.
Attorney for Applicant
Reg. No. 34,751
Weiss & Weiss
500 Old Country Road
Suite 305
Garden City, New York 11530

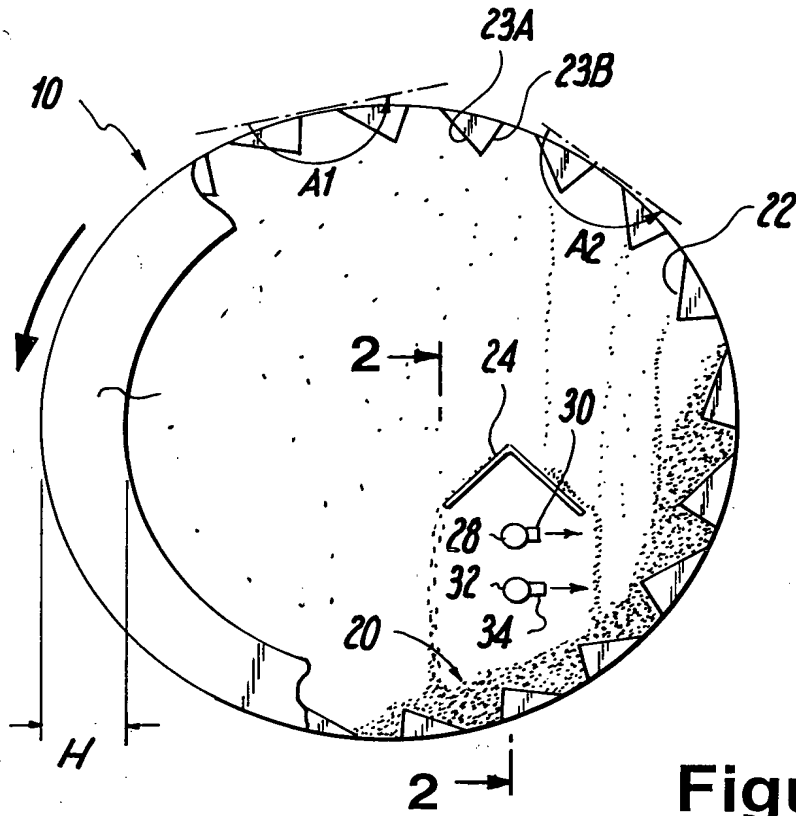


Figure 1

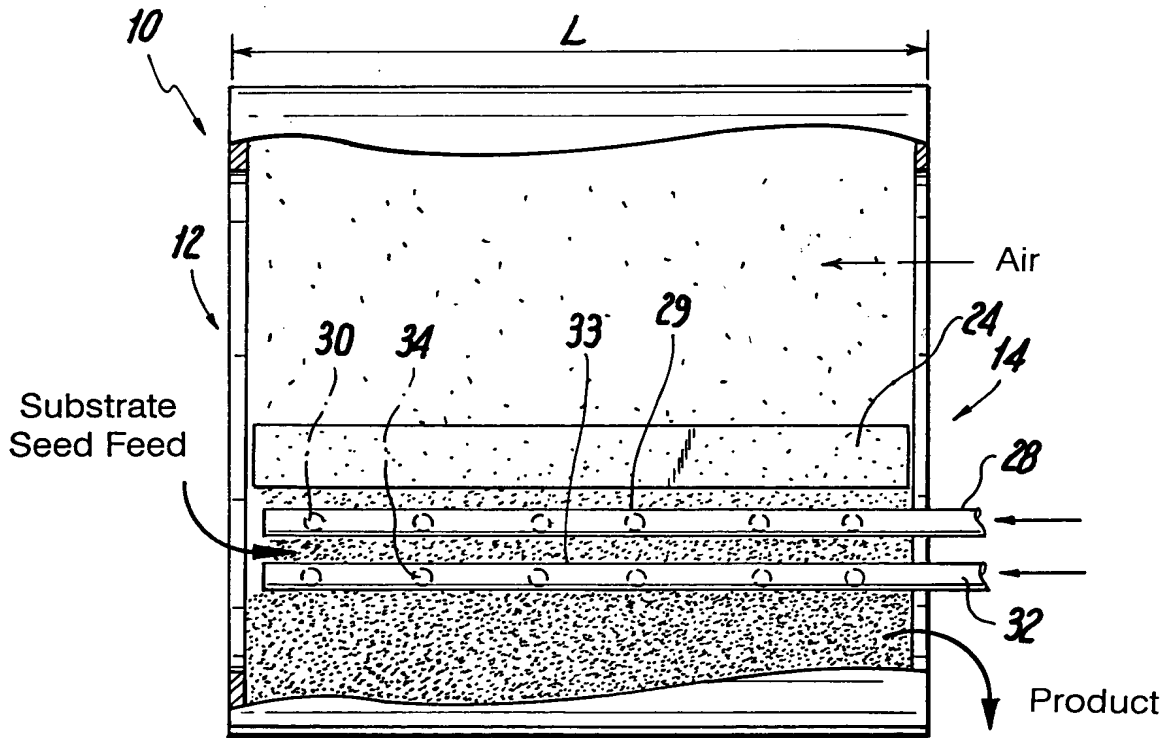


Figure 2

Figure 3

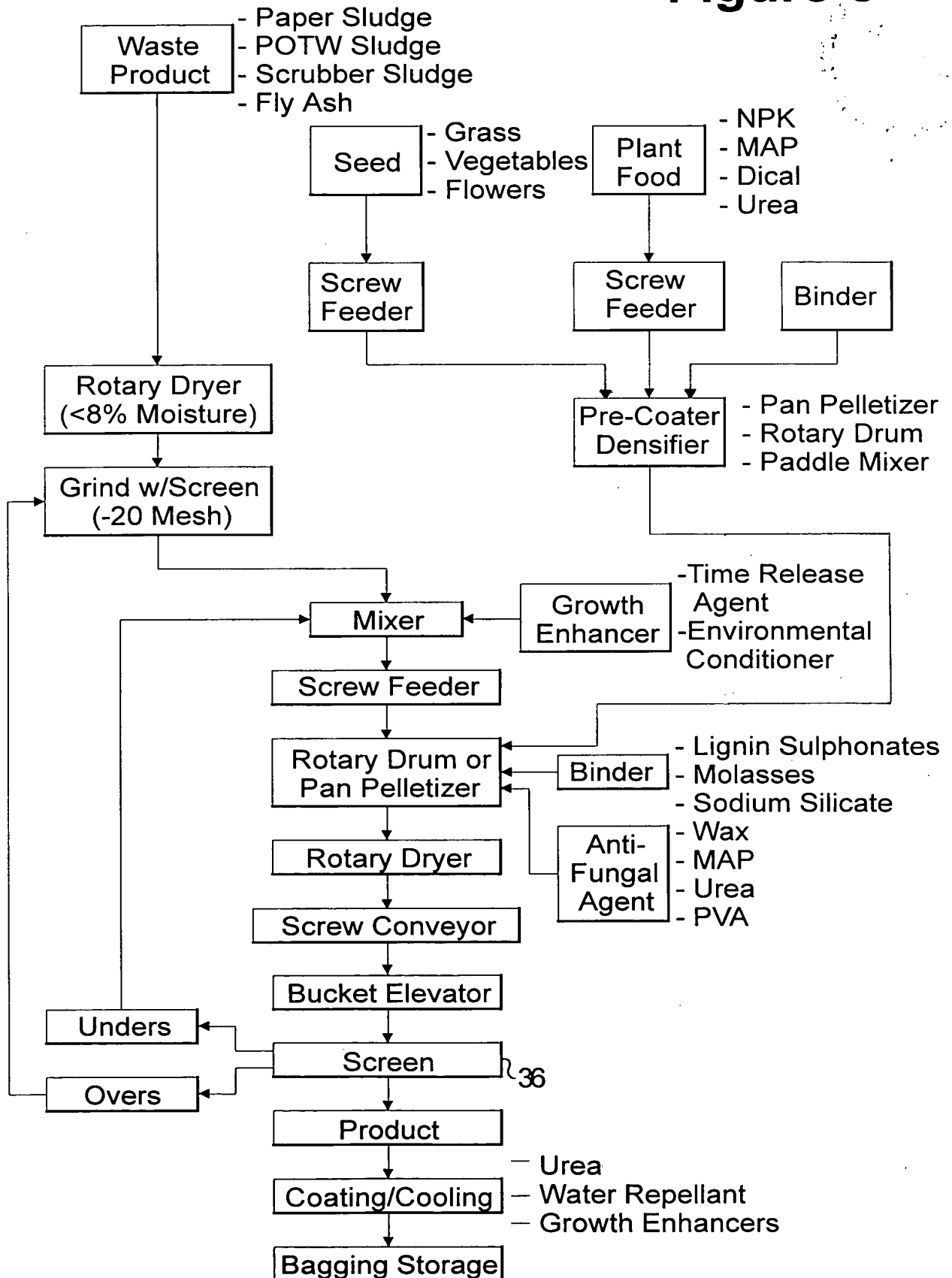
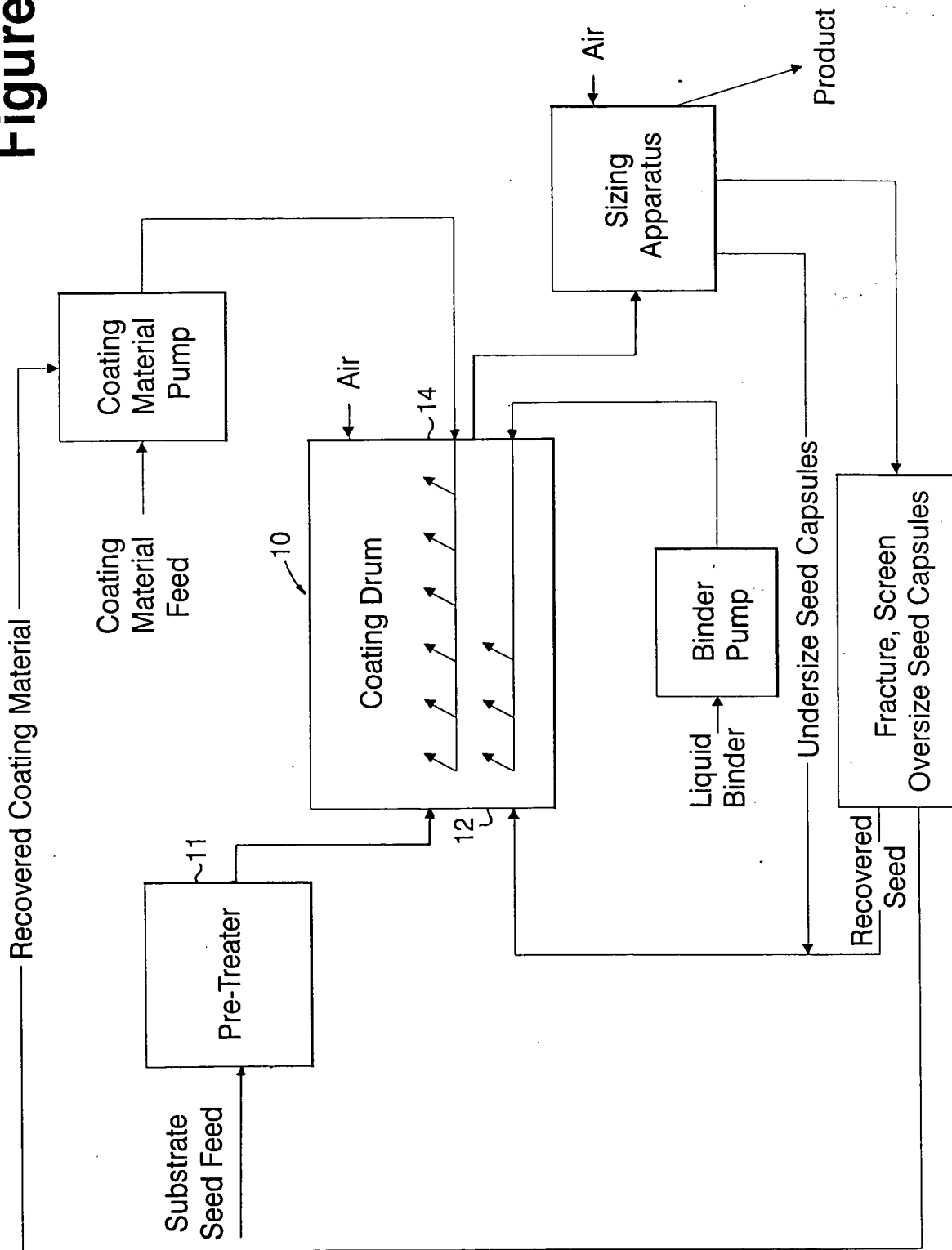


Figure 4



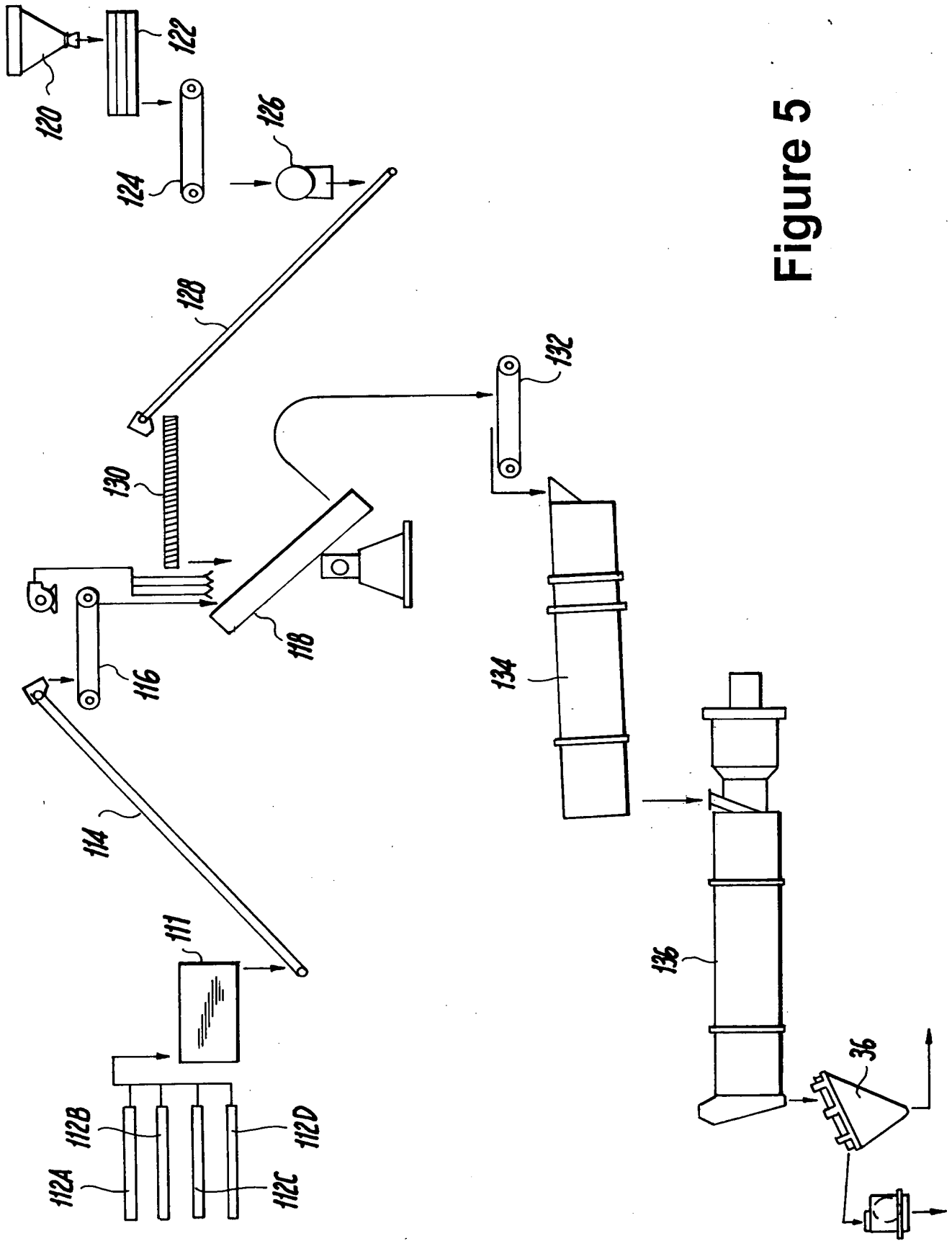


Figure 5

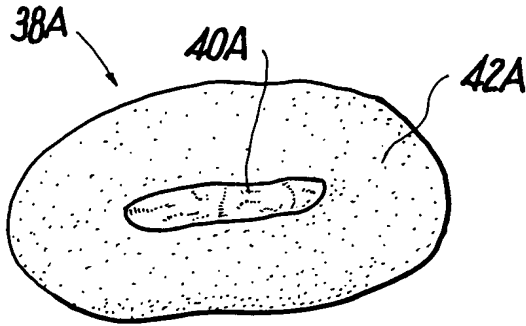


Figure 6A

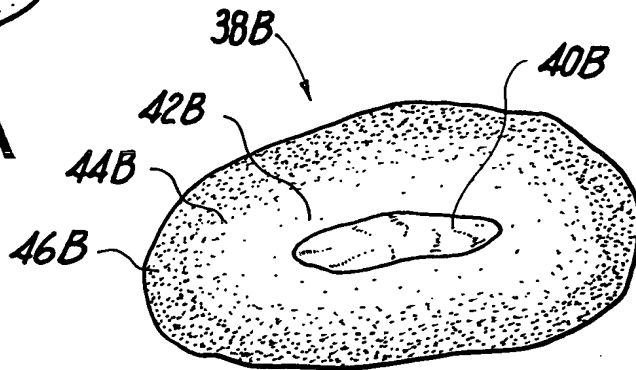


Figure 6B

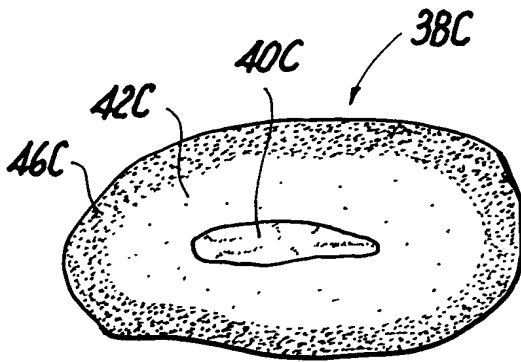


Figure 6C

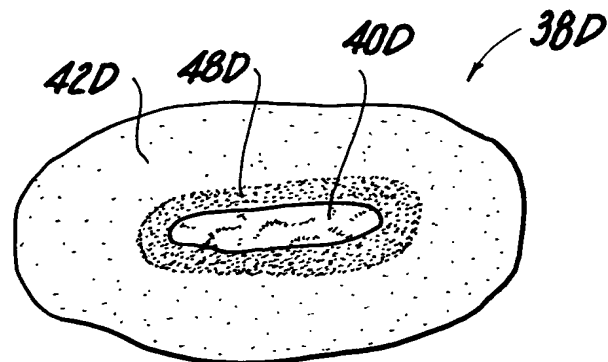


Figure 6D

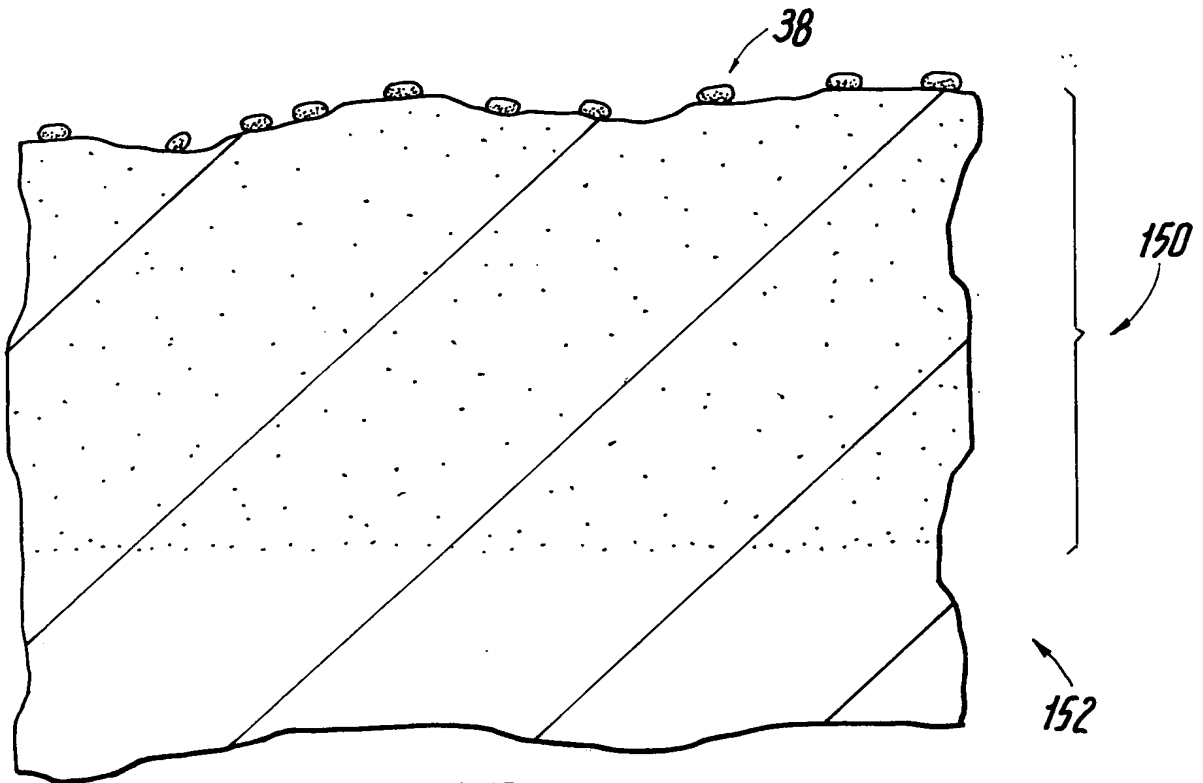


Figure 7

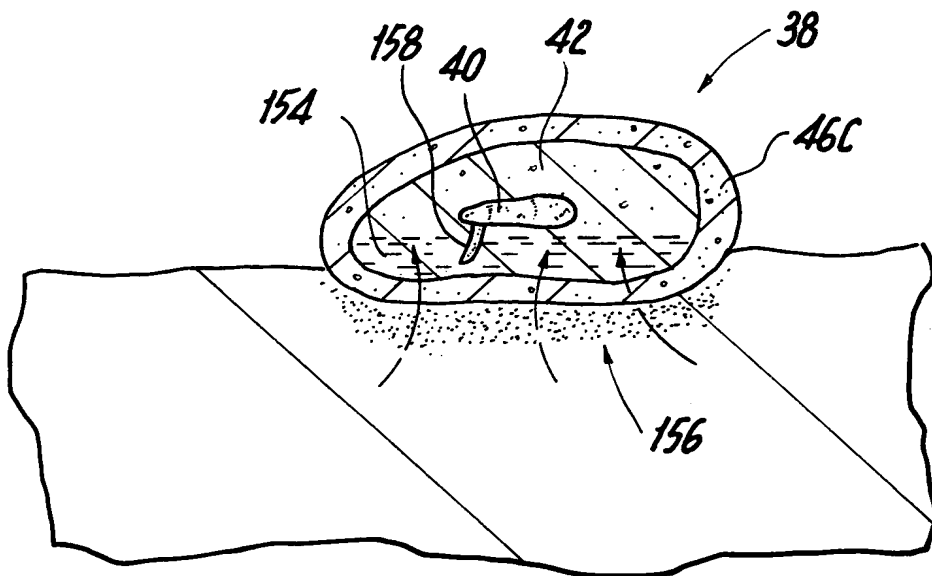


Figure 8



VB

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

HM12/0926

PHILIP M. WEISS
WEISS & WEISS
500 OLD COUNTRY ROAD
GARDEN CITY NY 11630

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
09/113,254	07/10/98	014	GRUNBERG, A	1661 09/26/00
First Named Applicant	MADIGAN,	35 USC 154(b) term ext. =		0 Days.

TITLE OF INVENTION SEEDING TREATMENTS

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
3 29214		047-057.600	S82 UTILITY	NO	\$1210.00	12/26/00

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.

HOW TO RESPOND TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

- A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or
- B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

- A. Pay FEE DUE shown above, or
- B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.


III. All communications regarding this application must give application number and batch number. Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

File

Notice of Allowability

Application No. 09/113,254	Applicant(s) Madigan et al.
Examiner Anne Marie Grunberg	Group Art Unit 1661



All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

This communication is responsive to papers faxed 8/21/2000

The allowed claim(s) is/are 77, 79-81, 83-88, 90-93 (renumbered as 1-14)

The drawings filed on _____ are acceptable.

Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

All Some* None of the CERTIFIED copies of the priority documents have been
 received.

received in Application No. (Series Code/Serial Number) _____

received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE **THREE MONTHS** FROM THE "DATE MAILED" of this Office action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

Applicant MUST submit NEW FORMAL DRAWINGS

because the originally filed drawings were declared by applicant to be informal.

including changes required by the Notice of Draftsperson's Patent Drawing Review, PTO-948, attached hereto or to Paper No. 5.

including changes required by the proposed drawing correction filed on _____, which has been approved by the examiner.

including changes required by the attached Examiner's Amendment/Comment.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any response to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

Notice of References Cited, PTO-892

Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

Notice of Draftsperson's Patent Drawing Review, PTO-948

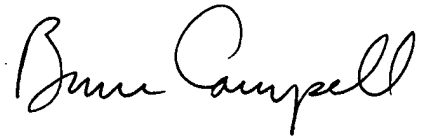
Notice of Informal Patent Application, PTO-152

Interview Summary, PTO-413

Examiner's Amendment/Comment

Examiner's Comment Regarding Requirement for Deposit of Biological Material

Examiner's Statement of Reasons for Allowance



**BRUCE R. CAMPPELL, PH.D
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1600**

Art Unit: 1661

The Group and/or Art Unit location of your application in the PTO has changed. To aid in correlating any papers for this application, all further correspondence regarding this application should be directed to Group Art Unit 1661.

DETAILED ACTION

Examiner's Amendment

1. An Examiner's Amendment to the record appears below. Should the changes and/or additions be unacceptable to Applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the Issue Fee.

IN THE CLAIMS

~~1~~ (Amended) A combination seed capsule comprising:
one viable seed;
said seed acting as a core or pseudo core of said combination seed capsule;
a coating of a composition comprising soil conditioning materials;
said soil conditioning materials being in a solid state at time of coating.--

C

55
P. 54

Art Unit: 1661

~~7~~ (Amended)

A combination seed capsule comprising:

one viable seed;

said seed acting as a core or pseudo core of said combination seed capsule;

a coating of a composition comprising soil conditioning materials;

said coating being applied to said viable seed by an agglomeration

operation;

wherein said soil conditioning materials are in a solid state at time of coating.

The above changes were authorized by attorney Phillip Weiss in a telephone interview with Examiner Grünberg on September 8, 2000.

Drawings

2. In order to avoid abandonment, the drawing informalities noted in Paper No. 5, on the Notice of Draftsperson's Patent Drawing Review, and the Office Action, mailed on 18 June, 1999, must now be corrected. Correction can only be effected in the manner set forth in the above noted paper.

Art Unit: 1661

2. Any inquiry concerning this or any previous communication from the examiner should be directed to Anne Marie Grünberg whose telephone number is (703) 305-0805. The Examiner can normally be reached Monday through Thursday from 6:30 am to 4:00 pm. The Examiner can also be reached on alternate Fridays from 7:30 am to 4:00 pm.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Bruce Campell, can be reached at (703) 308-4205. The fax phone number for the group is (703) 305-3014.

Any inquiry of a general nature or relating to the status of this application should be directed to THE MATRIX CUSTOMER SERVICE CENTER whose telephone number is (703) 308-0196.




**BRUCE R. CAMPPELL, PH.D
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1800**

Anne Marie Grünberg



Interview Summary

Application No. 09/113,254	Applicant(s) Madigan et al.
Examiner Anne Marie Grunberg	Group Art Unit 1661



All participants (applicant, applicant's representative, PTO personnel):

- (1) Anne Marie Grunberg (3) _____
(2) Phillip Weiss (4) _____

Date of Interview Aug 8, 2000

Type: Telephonic Personal (copy is given to applicant applicant's representative).

Exhibit shown or demonstration conducted: Yes No. If yes, brief description:

Agreement was reached. was not reached.

Claim(s) discussed: 76-94

Identification of prior art discussed:
Roth

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:
Claim language was discussed, in particular it was discussed if "wherein said soil conditioning material, when added to the seed, are in a dry, solid form: and," if inserted into the independent claims, would be enough to overcome Roth. It was suggested that the claims be written in a product by process form to clearly distinguish over Roth.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.


2. Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign and stamp this form unless it is an attachment to a signed Office action.

<u>DB Name</u>	<u>Query</u>	<u>Hit Count</u>	<u>Set Name</u>
JPAB,EPAB	120	0	<u>L21</u>
USPT	117 and 119	108	<u>L20</u>
USPT	@py<1998	6129483	<u>L19</u>
USPT	117@py<1998	4294967295	<u>L18</u>
USPT	116 and 113	120	<u>L17</u>
USPT	((47/57.6)!.CCLS.)	379	<u>L16</u>
USPT	((47/!)!.CCLS.)	0	<u>L15</u>
USPT	47.ccls	0	<u>L14</u>
USPT	18 and 112	1209	<u>L13</u>
USPT	13 same 14	1298	<u>L12</u>
USPT	15 and 110	3711	<u>L11</u>
USPT	13 and 18	5346	<u>L10</u>
USPT	13 and 18	5346	<u>L9</u>
USPT	16 or 17	1004442	<u>L8</u>
USPT	powder or powdery or dust or dusty	363204	<u>L7</u>
USPT	dry or solid	889500	<u>L6</u>
USPT	13 and 14	4196	<u>L5</u>
USPT	soil or earth or ground	568955	<u>L4</u>
USPT	11 same 12	6208	<u>L3</u>
USPT	coat or coating or coated or agglomerate or agglomeration or agglomerated	533284	<u>L2</u>
USPT	seed	64826	<u>L1</u>

Interview Summary

Application No. 09/113,254	Applicant(s) Madigan et al.
Examiner Anne Marie Grunberg	Group Art Unit 1661



All participants (applicant, applicant's representative, PTO personnel):

- (1) Anne Marie Grunberg (3) _____
(2) Philip Weiss (4) _____

Date of Interview Sep 8, 2000

Type: Telephonic Personal (copy is given to applicant applicant's representative).

Exhibit shown or demonstration conducted: Yes No. If yes, brief description:

Agreement was reached. was not reached.

Claim(s) discussed: 77 and 85

Identification of prior art discussed:

Roth

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:
Based on the proposed draft amendment and arguments recited therein, the prior art was overcome.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign and stamp this form unless it is an attachment to a signed Office action.



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application: Madigan et al.

Serial No.: 09/113,254

Group Art Unit: 1638

Filed: July 10, 1998

Examiner: A. Grunberg

For: SEEDING TREATMENTS

Box Response
Assistant Commissioner for Patents
Washington, D.C. 20231

RESPONSE TO OFFICE ACTION

The following is in response to the Office Action mailed May 10, 2000.

In the Claims:

Cancel claims 70-73, 76, 78, 82, 89 and 94-100.

Claim 77 (amended) A combination seed capsule comprising:

[at least] one viable seed;

said seed acting as a core or pseudo core of said combination seed capsule;

[coatings] a coating of a composition comprising [a growth enhancer and material

finer] soil conditioning materials;

said coating being an integral part of said seed.

[Claim 79 lines 1-2 change "material fines" to] soil conditioning materials--;

Claim 79 line 2 change "industrial byproduct" to -- sludge or fly ash --;

Claim 80 line 1 change "79" to -77--;

Claim 80 line 2 before "byproduct" insert -- fiber containing --;

Claim 81 line 1 change "79" to -80--;

B1

Claim 83 line 1 change "material fines" to -- soil conditioning materials --;

Claim 84 line 1 change "material fines" to -- soil conditioning materials --;

Claim 84 line 2 change "grassy/woody substances" to -- sawdust --;

Claim 85 line 2 delete "at least";

Claim 85 line 4 change "material fines" to -- soil conditioning materials --;

Claim 85 line 5 change "a lifting and mixing" to -- an --;

Claim 86 lines 1-2 change "material fines" to -- soil conditioning materials --;

Claim 86 line 2 change "industrial byproduct" to -- sludge or fly ash --;

Claim 87 line 2 before "byproduct" insert -- fiber containing --;

Claim 88 line 1 change "86" to --87--;

Claim 90 line 1 change "material fines" to -- soil conditioning materials --;

Claim 91 line 1 change "material fines" to -- soil conditioning materials --;

Claim 91 line 2 "grassy/woody substances" to -- sawdust --;

Claim 93 line 2 change "material fines" to -- soil conditioning materials --;

Claim 93 line 1 change "85" to -- 92 --.

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Response

Applicant has canceled claims 70-73, 76, 78, 82, 89 and 94. Applicant has amended the claims as requested by the Examiner.

Examiner has rejected claim 77 under 35 U.S.C. §102 as being anticipated by Gerber. Claim 77 has been amended to add the element that the coating being an integral part of said seed. Further, claim 77 has been amended to claim only one viable seed. Gerber teaches a seed capsule having a number of seeds. Paragraph 7 of Krysiak Declaration. Gerber describes a mixture of seeds and loess which are pressed together.

They form a thistle ball. This differs from the encapsulated seed of the present invention because the thistle ball of Gerber includes multiple seeds, loess and the ball is not an integral part of the seed. Further, Gerber does not describe an agglomeration process. Paragraph 8 of Krysiak Declaration.

Examiner has rejected claims 76-78 and 83 under 35 U.S.C. §102 as being anticipated by Roth. Applicant has canceled claim 76 and amended claim 77, 78 and 83. Roth differs from the encapsulated seed of the present invention because Roth does not describe the coating to be an integral part of the seed. Rather, Roth teaches a novel means for releasing sludge into the surrounding soil. In addition, Roth describes the sprayed-on coating as a film with film forming properties. The process described in Roth does not teach the agglomeration process of the present invention. The coating of Roth is described as a thin continuous film. Paragraphs 10 and 11 of Krysiak Declaration.

Examiner has rejected claims 77, 79-81 and 84 under 35 U.S.C. §102 as being anticipated by Nilsson. Nilsson describes the introduction of the seed or seeds into a cover. The cover may be made into halves or parts, at least one part or half of which comprises a suitable recess for the seed or seeds. After introducing the seed into the recess, the capsule parts are secured to each other. Paragraph 13 of the Krysiak Declaration.

Nilsson differs from the present invention because Nilsson does not describe a coating, which is an integral part of the seed. Nilsson describes a shell of paper where the seed is placed within the shell. The shell has spaces which allow gas and liquid to penetrate. Further, Nilsson does not describe an agglomeration process. Paragraph 14 of the Krysiak Declaration.

Examiner has rejected claims 77, 79-81, 84-88 and 91-94 under 35 U.S.C §102 as being anticipated by Loperfido. Loperfido describes coated seeds having a coating comprising non-porous, hydrophobic, non-phytotoxic particles which are adhered to each other and to the seeds by a hydrophilic binder in such a manner that the coating is highly porous and provides facile gas and water exchange between the seed and its environment. Due to the hydrophilic nature of the binder, it will be dissolved readily by soil moisture. Dissolution of the binder destroys the mechanical integrity of the coating. The coating allows the maximum amount of air space in the coated seed. Paragraphs 16-18 of the Krysiak Declaration.

Loperfido differs from the encapsulated seed of the present invention because Loperfido does not teach a coating being an integral part of the seed. Loperfido teaches a binder added to the seed that does not uniformly coat the seed. The coating forms beads that then collect around the seed. The coating formed around the seed is of a highly porous nature. Loperfido describes allowing a maximum amount of air space between the coating and the seed. Paragraph 19 of the Krysiak Declaration.

Examiner has rejected claims 76-94 under 35 U.S.C. §103 as being unpatentable over Loperfido in view of Roth and further in view of Nelson. None of these references describes the coating as being an integral part of these seed.

None of the products described in the prior art patents have ever been made commercially. Paragraph 20 of the Krysiak Declaration. The present invention provides a soil conditioner in intimate association with the seed. The present invention provides a uniformity of coating or coating thickness so that the seed is not on or immediately adjacent an outside surface of the capsule such that the seed may fall out, or be easily

broken out, of the capsule, or easily removed by dissolution of materials at and near the surface of the seed capsule. Paragraph 22 of the Krysiak Declaration.

The present invention applies a seed in a seed capsule wherein the seed is intimately combined with a soil conditioning material in a common particle. This was not taught prior to the present invention. After a review of the prior art provided by the Examiner, this statement is still true. Paragraph 24 of the Krysiak Declaration.

Figures 6A-6D of the present invention illustrate the seed in intimate association with the soil conditioning material. The present invention comprises a combination seed capsule having a viable seed acting as a core or pseudo core. A coating of a composition comprising a soil conditioning material is an integral part of the seed. None of the prior art describes these elements. Further, where the coating is applied in an agglomeration operation is also not described in the prior art. Paragraph 29 and 30 of the Krysiak Declaration.

Enclosed is a sample of EncapSeed which was prepared according to the method described in the present invention. As shown by the enclosed EncapSeed, the coating is an integral part of the seed. The seed (an all-purpose grass seed mixture) comprises 32% of the overall product weight. The blanket that is wrapped around the seed is comprised of dicalcium phosphate (.8%) and dried, ground paper sludge (67.2%). The dried, ground paper fines range in size from approximately 30 mesh to approximately 200 mesh. Of this total material, 68.5% is comprised of inert material. The EncapSeed coating has no visible spaces between the coating and the seed is designed to act as the microenvironment for the seed for the germination process. Field tests by the University

of Wisconsin-Madison's Horticultural Department have shown that the EncapSeed blanket helps to enhance turf establishment. Paragraph 31 of the Krysiak Declaration.

Applicant now believes that the application is in condition for allowance.

Respectfully submitted,



Philip M. Weiss, Esq.
Reg. No.: 34,751

07-14-00
MAY 1638
Box 582



P/23-3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application: Madigan et al.

Serial No.: 09/113,254

Group Art Unit: 1638

Filed: July 10, 1998

Examiner: A. Grunberg

For: SEEDING TREATMENTS

Box Response
Assistant Commissioner for Patents
Washington, D.C. 20231

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JUL 20 2000

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Enclosed please Response to Office Action, Declaration of Michael Krysiak,

Seed Sample. Please stamp postcard and return.

Respectfully submitted,

Philip M. Weiss, Esq.
Reg. No.: 34,751

Express Mail mailing label No.: EL63689424045

Date of Deposit: July 13, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner of Patents, Washington, DC 20231

Date

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7-27-00



P/23-3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application: Madigan et al.

Serial No.: 09/113,254

Group Art Unit: 1638

Filed: July 10, 1998

Examiner: A. Grunberg

For: SEEDING TREATMENTS

DECLARATION OF MICHAEL KRYSIAK

Assistant Commissioner for Patents
Washington, D.C. 20231

I, Mike Krysiak, residing at 3554 Highland Center Drive, Green Bay, Wisconsin, 54311 declares as follows;

1. I graduated from the University of Wisconsin-Milwaukee majoring in Industrial Engineering.
2. I have given various presentations relating to seed encapsulation, green building, quality and service throughout the United States.
3. I worked for FEECO International, Inc. as Manager of Quality and Service for six years. FEECO designs, builds and installs material processing equipment for companies in the environmental and fertilizer markets. During my last two years at FEECO I worked on the development of the EncapSeed products in our Pilot Lab. Prior to FEECO, I worked at Krueger International (KI) as an Industrial/Quality Engineer.
4. I presently am the President and CEO of Encap. Encap is in the business of encapsulating seeds.
5. I am a named inventor of the 09/113,254 patent application. I have reviewed the Office Action dated May 10, 2000.
6. I have reviewed the Examiner's rejection regarding Gerber and have reviewed the Gerber Patent.
7. Gerber teaches a seed capsule having a number of seeds not more than 4 percent of the total weight of the capsule. Col. 5 lines 23-27.

8. Gerber describes a mixture of seeds and loess which are pressed together. They form a thistle ball. This differs from the encapsulated seed of the present invention because the thistle ball of Gerber includes multiple seeds, loess and the ball is not an integral part of the seed. Further, Gerber does not describe an agglomeration process.

9. I have reviewed the Examiner's rejection over Roth and have reviewed the Roth patent.

10. Roth describes coating crop seeds with an MAS carrier having one or more agricultural chemicals dispersed therein. The process of coating is described as dipping, soaking, spraying, or other conventional mode of application. Col. 4 lines 46-50. Crop seeds described are corn, sorghum and soy. Col. 4 lines 60-62. The coating is described as a thin continuous film. Col. 4 lines 3-5.

11. Roth differs from the encapsulated seed of the present invention because Roth only describes spraying sludge on seeds. The spray does not become an integral part of the seed. Nor does the spraying describe an agglomeration process.

12. I have reviewed the Examiner's rejection over Nilsson and have reviewed the Nilsson patent.

13. Nilsson describes the introduction of the seed or seeds into a cover. The cover may be made into halves or parts, at least one part or half of which comprises a suitable recess for the seed or seeds. After introducing the seed into the recess, the capsule parts are secured to each other. Col. 2 lines 11-25, Col. 3 lines 45-52.

14. Nilsson differs from the present invention because Nilsson does not describe a coating which is an integral part of the seed. Nilsson describes a shell of paper where the seed is placed within the shell. The shell has spaces which allow gas and liquid to penetrate. Further, Nilsson does not describe an agglomeration process.

15. I have reviewed the Examiners rejection over Loperfido and have reviewed the Loperfido patent.

16. Loperfido describes coated seeds having a coating comprising non-porous, hydrophobic, non-phytotoxic particles which are adhered to each other and to the seeds by a hydrophilic binder in such a manner that the coating is highly porous and provides facile gas and water exchange between the seed and its environment. Abstract of the Invention.

17. Due to the hydrophilic nature of the binder, it will be dissolved readily by soil moisture. Dissolution of the binder destroys the mechanical integrity of the coating. Col. 5 lines 4-6.

18. The coating allows the maximum amount of air space in the coated seed. Col. 4 lines 21-22 .

19. Loperfido differs from the encapsulated seed of the present invention because Loperfido does not teach a coating being an integral part of the seed. Loperfido teaches a binder added to the seed that does not uniformly coat the seed. The coating forms beads that then collect around the seed. The coating formed around the seed is of a highly porous nature. Loperfido describes allowing a maximum amount of air space between the coating and the seed.

20. None of the products described in the prior art patents have ever been made commercially.

21. The present invention provides a soil conditioner in intimate association with the seed. Specification Pg. 15 lines 32-33.

22. The present invention provides a uniformity of coating or coating thickness so that the seed is not on or immediately adjacent an outside surface of the capsule such that the seed may fall out, or be easily broken out, of the capsule, or easily removed by dissolution of materials at and near the surface of the seed capsule. Specification Pg. 17 line 31 – Pg. 18 line 3.

23. The present invention prepares a seed that becomes generally uniformly coated with one or more layers of the coating material such that the coating material becomes an integral part of the respective seed capsule. As the coating material solidifies on the seed, the coating material tightly bonds to the respective portions of the seeds. Specification Pg. 22 lines 14-22.

24. The present invention applies a seed in a seed capsule wherein the seed is intimately combined with a soil conditioning material in a common particle. Specification Pg. 35 lines 23-25. This was not taught prior to the present invention. After a review of the prior art provided by the Examiner, this statement is still true.

25. The prior art does not show the soil conditioning material nor the inorganic fertilizer intimately associated in a common capsule or other particle as in the present invention. Specification Pg. 38 lines 30-33.

26. Where the soil conditioning and fertilizer materials are applied separate from the seed, the potential cooperative benefit of the soil conditioning material as relates to solution and up-take of soil moisture and or of the inorganic chemical fertilizer by the seed are not obtained, and/or are not obtained in controlled close association with the seed. Specification Pg. 32 lines 1-10.

27. When applied separately to the soil, the seed and the soil conditioner are not necessarily in intimate contact with each other as they are when both materials are combined into a single combined seed capsule product as in the present invention. Specification Pg. 39 lines 19-23.

28. In the present invention, soil conditioning material and optionally chemical fertilizer, are inherently bound to each other, and to the seed, as by the agglomeration process, and inherently assist the seed in achieving desired germination and strong early growth. Specification Pg. 42 lines 27-31.

29. Figures 6A-6D of the present invention illustrate the seed in intimate association with the soil conditioning material.

30. The present invention comprises a combination seed capsule having a viable seed acting as a core or pseudo core. A coating of a composition comprising a soil conditioning material is an integral part of the seed. None of the prior art describes these elements. Further, where the coating is applied in an agglomeration operation is also not described in the prior art.

31. Enclosed is a sample of EncapSeed which was prepared according to the method described in the present invention. As shown by the enclosed EncapSeed, the coating is an integral part of the seed. The seed (an all-purpose grass seed mixture) comprises 32% of the overall product weight. The blanket that is wrapped around the seed is comprised of dicalcium phosphate (.8%) and dried, ground paper sludge (67.2%). The dried, ground paper fines range in size from approximately 30 mesh to approximately 200 mesh. Of this total material, 68.5% is comprised of inert material. The EncapSeed coating has no visible spaces between the coating and the seed is designed to act as the microenvironment for the seed for the germination process. Field tests by the University of Wisconsin-Madison's Horticultural Department have shown that the EncapSeed blanket helps to enhance turf establishment.

I declare under the penalty of perjury that the foregoing is true and correct.

Date: June 27, 2000


Michael Krysiak



**UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

kd

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/113,254	07/10/98	MADIGAN	D 29214

HM12/0510

PHILIP M. WEISS
WEISS & WEISS
500 OLD COUNTRY ROAD
GARDEN CITY NY 11630

EXAMINER

GRUNBERG, A

ART UNIT	PAPER NUMBER
1638	10


DATE MAILED: 05/10/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No. 09/113,254	Applicant(s) Madigan et al.
Examiner Anne Marie Grunberg	Group Art Unit 1638



Responsive to communication(s) filed on Dec 14, 1999

This action is FINAL.

Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire three month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

- Claim(s) 70-73 and 76-100 is/are pending in the application.
- Of the above, claim(s) 70-73 and 95-100 is/are withdrawn from consideration.
- Claim(s) _____ is/are allowed.
- Claim(s) 76-94 is/are rejected.
- Claim(s) _____ is/are objected to.
- Claims _____ are subject to restriction or election requirement.

Application Papers

- See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- The drawing(s) filed on _____ is/are objected to by the Examiner.
- The proposed drawing correction, filed on _____ is approved disapproved.
- The specification is objected to by the Examiner.
- The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- All Some* None of the CERTIFIED copies of the priority documents have been
- received.
- received in Application No. (Series Code/Serial Number) _____.
- received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

- Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- Notice of References Cited, PTO-892
- Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
- Interview Summary, PTO-413
- Notice of Draftsperson's Patent Drawing Review, PTO-948
- Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

Art Unit: 1638

DETAILED ACTION

The Group and/or Art Unit location of your application in the PTO has changed. To aid in correlating any papers for this application, all further correspondence regarding this application should be directed to Group Art Unit 1638.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Originally withdrawn claims 70-73 are still pending. Since they were not elected in response to the original restriction requirement, they should be canceled.

Newly submitted claims 95-100 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: Claims 95-100 are drawn to a method of making capsules; Group II as set forth in the last office action, whereas the elected invention was drawn to a seed capsule and methods of use, Group I as set forth in the last office action.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 95-100 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Applicant's election of Group I in Paper No. 5 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Art Unit: 1638

Claim Rejections

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 77, 83-86, 90-91 and 93 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 77, 83-86, 90-91 and 93 are indefinite for the terminology “material fines”. This term is not defined in the specification and the metes and bounds of the claim can not be readily determined by one skilled in the art. This rejection may be obviated by deletion of “material fines” and substituting the term --soil conditioning materials-- as is described on page 13, lines 16-19 of the specification.

Similarly claims 79 and 86 are vague and indefinite in the use of “industrial byproduct”. Changing this term to --sludge-- or --fly ash-- as described on page 13, lines 17-19 of the specification, would obviate this rejection.

In addition, claims 80 and 87 are vague and indefinite in the terminology “byproduct of a paper making process” as a byproduct could be anything, including for example, contaminated water. Insertion of --fiber-containing-- before “byproduct” as described on page 9, line 9 of the specification, would obviate this rejection.

Art Unit: 1638

Claim 84 is vague and indefinite in the terminology "grassy/woody substances". This rejection may be obviated by changing the term to state --sawdust--.

Claim 85 is vague and indefinite in the terminology "lifting and mixing agglomeration operation". The phrase is not defined in the specification and it is not clear as to what exactly constitutes a lifting and mixing agglomeration operation. As a result, the metes and bounds of the claim can not be adequately determined. This rejection may be obviated by deleting "a lifting and mixing" and substituting --an-- in its stead to reflect terminology used on page 28, line 20 of the specification.

Claim 94 is vague and indefinite in the terminology "binder contains lignin". This term is not defined in the specification, nor is there support to clarify what the terminology encompasses. As a result, the metes and bounds of the claim can not be determined by one skilled in the art. It is suggested that Applicant cancel this claim.

3. Claim 93 recites the limitation "said binder" in reference to claim 85. There is insufficient antecedent basis for this limitation in the claim. This rejection may be obviated by amending the claim to delete "claim 85" and change it to read --claim 92--.

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to

Art Unit: 1638

make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 77,83-86, 90-91 and 93-94 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification provides no guidance in identifying “material fines”, or a “binder [that] contains lignin”. The specification does not contain guidance as to what a material fine would be, nor is it understood what form of lignin would be contained in what type of binder. In contrast, the claims are broadly drawn to any material fine, and any binder that contains lignin. In addition, these phrases are considered to be new matter since the specification as originally filed does not contain these items. The terms “grassy/woody substances” and “lifting and mixing agglomeration operation” are also considered to be new matter since they are not in the specification as originally filed.

The use of any type of material fine, or a binder which contains lignin is unpredictable due to the environmental impacts associated with certain material fines, and the germination characteristics of the seed and sensitivity of the seed to adhesive compounds, as set forth below.

Nelson teaches in column 2, lines 12-16, for example, that certain flue gas desulfurization wastes are not appropriate for soil amendments, owing to their high solubilities in water.

Art Unit: 1638

Porter et al teach in column 2, lines 21-30, for example, that selection of a suitable adhesive or binder, must take into account the germination characteristics of the seed and the sensitivity of the seed to damage caused by harsh chemicals that might be present in adhesive compounds.

Given the claim breadth, unpredictability, and lack of guidance as discussed above, undue experimentation would have been required by one skilled in the art to determine what type of material fines, and what type of lignin-containing binder could be used. Undue experimentation would also be required to identify appropriate grassy/woody substances and lifting and mixing agglomeration operations.

This rejection may be obviated by amending the claims as suggested in the section dealing with the second paragraph of 35 U.S.C. 112.

5. New claim 77 is rejected under the previously applied 35 U.S.C. 102(b) as being anticipated by Gerber.

Claim 77 is drawn to a combination seed capsule comprising at least one viable seed which acts as a core or pseudo-core of the seed capsule, and seed coatings comprising a growth enhancer and material fines.

Gerber teaches a combination seed capsule comprising at least one viable seed; said seed acting as a core or pseudo-core of said combination seed capsule (column 1, lines 61-63). Gerber

Art Unit: 1638

also teaches seed coatings comprising a growth enhancer and material fines (column 2, line 7; column 2, lines 52-56; column 3, lines 22-41).

This rejection may be obviated by inserting at the end of the claim --; said seed capsule ~~having an inner layer comprising a soil conditioning material selected from the group consisting of municipal or sewage sludge, scrubber sludge, paper mill sludge, sawdust, fly ash, dust and animal waste;~~

~~and said seed capsule having an outer layer comprising a material selected from the group consisting of urea, an inorganic form of a plant nutrient, herbicides, fungicides, and ingredients effective to reduce susceptibility of the seed capsule to deleterious effects of animals; wherein the inner layer is agglomerated onto the seed.--~~

6. New claims 76-78 and 83 are rejected under the previously applied 35 U.S.C. 102(b) as being anticipated by Roth.

Claims 76-78 and 83 are drawn to a combination seed capsule comprising at least one viable seed which acts as a core or pseudo-core of the seed capsule, and a seed coating comprising dicalcium phosphate. Additionally, the claims are drawn to seed coatings comprising a growth enhancer and material fines such as municipal sewage.

Roth teaches a combination seed capsule comprising at least one viable seed; said seed acting as a core or pseudo-core of said combination seed capsule (column 4, lines 31-50). Roth

Art Unit: 1638

also teaches a coating comprising “the phosphates,” which although it does not specifically state dicalcium phosphate, certainly includes dicalcium phosphate (column 3, line 10). Additionally Roth teaches coatings comprising a growth enhancer and material fines (column 3, lines 5-16). Roth also teaches material fines comprised of municipal sewage (column 4, lines 46-50).

This rejection may be obviated by inserting at the end of the claim --; said seed capsule having an inner layer comprising a soil conditioning material selected from the group consisting of municipal or sewage sludge, scrubber sludge, paper mill sludge, sawdust, fly ash, dust and animal waste;

and said seed capsule having an outer layer comprising a material selected from the group consisting of urea, an inorganic form of a plant nutrient, herbicides, fungicides, and ingredients effective to reduce susceptibility of the seed capsule to deleterious effects of animals;

wherein the inner layer is agglomerated onto the seed.--

7. New claims 77, 79-81 and 84 are rejected under the previously applied 35 U.S.C. 102(b) as being anticipated by Nilsson.

Claims 77, 79-81 and 84 are drawn to a combination seed capsule comprising at least one viable seed which acts as a core or pseudo-core of the seed capsule, and seed coatings comprising a growth enhancer and material fines. Additionally, the claims are drawn to material fines such as industrial byproducts, byproducts of a paper making process, paper sludge, and grassy/woody substances.

Art Unit: 1638

Nilsson teaches a combination seed capsule comprising at least one viable seed; said seed acting as a core or pseudo-core of said combination seed capsule (column 1, lines 38-49).

Nilsson also teaches seed coatings comprising a growth enhancer and material fines (column 1, lines 60-68; column 4, line 23). Additionally Nilsson teaches material fines comprised of industrial byproducts (column 1, line 65). Nilsson also teaches material fines which are byproducts of a paper making process (column 1, line 65), such as paper sludge (column 1, line 65). Nilsson also teaches material fines comprised of grassy/woody substances (column 1, lines 65).

This rejection may be obviated by inserting at the end of the claim --; said seed capsule having an inner layer comprising a soil conditioning material selected from the group consisting of municipal or sewage sludge, scrubber sludge, paper mill sludge, sawdust, fly ash, dust and animal waste;

and said seed capsule having an outer layer comprising a material selected from the group consisting of urea, an inorganic form of a plant nutrient, herbicides, fungicides, and ingredients effective to reduce susceptibility of the seed capsule to deleterious effects of animals;

wherein the inner layer is agglomerated onto the seed.--

8. Claims 77, 79-81, 84-88, and 91-94 are rejected under 35 U.S.C. 102(b) as being anticipated by Loperfido (newly applied).

Art Unit: 1638

Claims 77, 79-81, 84-88, and 91-94 are drawn to a combination seed capsule comprising at least one viable seed which acts as a core or pseudo-core of the seed capsule, and seed coatings comprising a growth enhancer and material fines. Additionally, the claims are drawn to material fines such as industrial byproducts, byproducts of a paper making process, paper sludge, grassy/woody substances. The claims are also drawn to a binder which may include fertilizer and which contains lignin.

Loperfido teaches a combination seed capsule comprising at least one viable seed which acts as a core or pseudo-core of the seed capsule (abstract, for example). The seed coatings comprise a growth enhancer (column 6, lines 37-46) and material fines (column 2, lines 63-66, for example). Loperfido teaches material fines such as cellulose derivatives, which would include byproducts of a paper making process, paper sludge, or grassy/woody substances (column 4, lines 13-14). Byproducts of a paper making process are industrial byproducts since paper making is an industry. The coating is applied by a lifting and mixing agglomeration operation (column 6, lines 65-67; column 7, lines 1-19, for example). Loperfido teaches a binder that is applied to the seed capsule (column 5, lines 26-30, for example). Additionally, Loperfido teaches a fertilizer as part of the material fines (column 6, lines 35-47). Loperfido also teaches a binder that contains lignin (column 5, line 1, for example).

This rejection may be obviated by inserting at the end of the claim --; said seed capsule having an inner layer comprising a soil conditioning material selected from the group consisting

Art Unit: 1638

of municipal or sewage sludge, scrubber sludge, paper mill sludge, sawdust, fly ash, dust and animal waste;

and said seed capsule having an outer layer comprising a material selected from the group consisting of urea, an inorganic form of a plant nutrient, herbicides, fungicides, and ingredients effective to reduce susceptibility of the seed capsule to deleterious effects of animals;

wherein the inner layer is agglomerated onto the seed.--

Additionally, the term "at least" in line 2 of claims 76, 77 and 85, should be deleted.

Applicant may attempt to distinguish the claimed invention by supplying a declaration which sufficiently shows that the seed capsule of the instant invention is distinct from a seed capsule made by the process of Loperfido. No commitment to patentability will be made prior to receipt and review of the declaration.

9. Claims 76-94 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loperfido in view of Roth, and further in view of Nelson (newly applied).

Claims 76-94 are drawn to a combination seed capsule comprising at least one viable seed which acts as a core or pseudo-core of the seed capsule, and a seed coating comprising dicalcium phosphate. Additionally, the claims are drawn to seed coatings comprising a growth enhancer and material fines such as municipal sewage, an industrial byproduct, paper sludge, fly ash, and grassy/woody substances. The claims are also drawn to the coating being applied by a lifting and mixing agglomeration operation.

Art Unit: 1638

Loperfido has been discussed previously.

Loperfido does not teach a coating or growth enhancer comprising dicalcium phosphate, nor does Loperfido teach material fines comprising fly ash or municipal sewage.

Roth teaches a coating comprising “the phosphates,” which although it does not specifically state dicalcium phosphate, certainly includes dicalcium phosphate (column 3, line 10). Roth also teaches material fines comprised of municipal sewage (column 4, lines 46-50).

Nelson teaches environmentally beneficial soil amendments such as fly ash (column 3, lines 60-63).

It would have been *prima facie* obvious to a person of ordinary skill in the art at the time the invention was made to utilize the combination seed capsules as taught by Loperfido, and to modify the capsules to include the fertilizer dicalcium phosphate, given the advantages of including fertilizers into the seed capsule as taught by Loperfido. It would also have been obvious to use material fines comprising municipal sewage or industrial byproducts such as fly ash, given the benefits of a low-cost carrier additive derived from sewage sludge as described by Roth (column 2, lines 1-45), and given the benefits of growth enhancing industrial byproducts such as fly ash as described by Nelson (column 3, lines 45-57).

This rejection may be obviated by inserting at the end of the claim --; said seed capsule having an inner layer comprising a soil conditioning material selected from the group consisting of municipal or sewage sludge, scrubber sludge, paper mill sludge, sawdust, fly ash, dust and animal waste;

Art Unit: 1638

and said seed capsule having an outer layer comprising a material selected from the group consisting of urea, an inorganic form of a plant nutrient, herbicides, fungicides, and ingredients effective to reduce susceptibility of the seed capsule to deleterious effects of animals;

wherein the inner layer is agglomerated onto the seed.--

Additionally, the term "at least" in line 2 of claims 76, 77 and 85, should be deleted.

Applicant may attempt to distinguish the claimed invention by supplying a declaration which sufficiently shows that the seed capsule of the instant invention is distinct from a seed capsule made by the process of Loperfido. No commitment to patentability will be made prior to receipt and review of the declaration.

Applicant's arguments filed 12/14/1999 have been fully considered but they are not persuasive.

The references supplied by the Applicant teach different coating and agglomeration techniques. The terminology in the art appears to be used interchangeably for different techniques. For example, on page 21 of Perry's Chemical Engineers' Handbook, liquid methods are characterized by spray or fluid bed agglomeration, whereas Hovmand appears to describe the same process on page 11, as a coating process. As a result, the previously applied art of Gerber, Roth and Nelson could be characterized as a coating or an agglomeration procedure.

No claim is allowed.

Art Unit: 1638

CLOSING REMARKS

Any inquiry concerning this or earlier communications from the examiner should be directed to Anne Marie Grünberg whose telephone number is (703) 305-0805. The examiner can normally be reached on Monday through Thursday from 7:30 to 5:00, and on alternate Fridays from 7:30 to 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynette Smith, can be reached on (703) 308-3909. The fax phone number for this Group is (703) 305-3014.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0196.

Anne Marie Grünberg

May 8, 2000

DAVID T. FOX
PRIMARY EXAMINER
GROUP ~~130~~ 1638



Notice of References Cited

Application No. 09/113,254	Applicant(s) Madigan et al.	
Examiner Anne Marie Grunberg	Group Art Unit 1638	Page 1 of 1

U.S. PATENT DOCUMENTS

* A	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
A	5,627,133	5/1997	Nelson	504	116
B	3,905,152	9/1975	Loperfido	47	57.6
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					

FOREIGN PATENT DOCUMENTS

* N	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N						
O						
P						
Q						
R						
S						
T						


NON-PATENT DOCUMENTS

* X	DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
X U	Hovmand, Granulation and agglomeration by fluidized bed and spray drying technology, pages 1, 10-11.	1982
X V	Briquetting, pelletizing, extrusion & fluid bed/spray granulation, table of contents, table 8-52.	1998
X W	Perry' Chemical Engineers' Handbook, 8-61	1978
X X	Briquetting, Pelletizing, Extrusion and Fluid Bed/Spray Granulation, Engelleitner, tables 23-24, page 21 and 23.	1998

* A copy of this reference is not being furnished with this Office action.
(See Manual of Patent Examining Procedure, Section 707.05(a).)

Interview Summary

Application No. 09/113,254	Applicant(s) Madigan et al.
Examiner Anne Marie Grunberg	Group Art Unit 1638



All participants (applicant, applicant's representative, PTO personnel):

- (1) Anne Marie Grunberg (3) _____
(2) Philip Weiss (4) _____

Date of Interview May 4, 2000

Type: Telephonic Personal (copy is given to applicant applicant's representative).

Exhibit shown or demonstration conducted: Yes No. If yes, brief description:

Agreement was reached. was not reached.

Claim(s) discussed: claims 70-73 and 76-100

Identification of prior art discussed:

Discussed prior art in general terms and more thoroughly discussed Roth, Gerber, and Nilsson among others.

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:

Discussed the general state of the prior art and how Applicant's invention differs from the prior art. Additionally, agglomeration methods were discussed.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign and stamp this form unless it is an attachment to a signed Office action.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of :
Madigan

Serial No.: 09/113,254

Filed: July 10, 1998

Title: SEEDING TREATMENTS



Date: 12/14/99
Group Art Unit: 1649
Examiner: Grunberg

8
w/ Atty.
3/3/99

RESPONSE TO OFFICE ACTION:

Sir:

In response to the Office Action mailed June 18, 1999 please amend the application as follows:

In the Specification

Pg. 8 Line 22 after "comprise" add --urea or--;

Line 24 delete "urea"

Line 26 change "micronutrient" to --nutrient--;

Pg. 9 Line 5 change "micronutrient" to--nutrient--;

Pg.10 Line 14 change "micronutrient" to --nutrient--;

Line 17 change "micronutrient" to --nutrient--;

Pg.14 Line 8 change "Inorganic chemical" to --chemical--;

Line 17 delete "inorganic";

Line 19 change "micronutrients" to --nutrients--;

Pg.18 Line 15 delete "inorganic";

Pg.19 Line 23 change "In" to --Referring to--;

Pg.34 Line 9 delete "inorganic";

A

Further, during the interview, applicant discussed that there was a difference between the agglomeration process described in the present application and the coating process described in the prior art. The Examiner requested publications which describe such a difference. These publications are attached along with this response. For example, the publications describe the difference between a tumbling and mixer agglomeration which is similar to the method described in the patent application verses spraying methods which are similar to the coating methods described in the prior art. The article, "Granulation and Agglomeration by Fluidized Bed and Spray Drying Technology" specifically describes the difference between "agglomeration technology" and "the technology of coating particles". Table 8-52 from the notes from "Briquetting, Pelletizing, Extrusion of Fluid Bed/Spray Granulation" April 1998 show the difference between tumbling and mixer agglomeration and other techniques, such as, spray methods. This same table is found in "Perry's Chemical Engineers Handbook". In "Briquetting, Pelletizing, Extrusion of Fluid Bed/Spray Granulation" 1995 describes the difference in Table 23 between "tumble agglomeration", the method described in the present patent application versus "coating techniques" which are described as a totally separate technique. The notes further described these two techniques as differing between agitation methods and liquid methods.

The present claims specifically refer to an agglomeration method which is different than a coating methods described in the prior art.



Therefore, the application is now in condition for allowance.

Philip M. Weiss

Philip M. Weiss
Reg. No. 34,751



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Date of Deposit: December 14, 1999

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is addressed to BOX Response,
Assistant Commissioner for
Patents, Washington D.C. 20231

Nelly Bronnberg

Nelly Bronnberg, December 14, 1999

A

Line 15 delete "inorganic";

Pg.37 Line 23 change "micronutrients" to --nutrients--;

In the Claims:

Delete Claims 1-69, 74 and 75

Add the following claims:

76. A combination seed capsule comprising:
at least one viable seed;
said seed acting as a core or pseudo-core of said combination
seed capsule;
a coating comprising dicalcium phosphate.

77. A combination seed capsule comprising:
at least one viable seed;
said seed acting as a core or pseudo-core of said combination
seed capsule;
coatings comprising a growth enhancer and material fines.

78. The combination seed capsule of claim 77 wherein said growth enhancer is
dicalcium phosphate.

²
~~79.~~ The combination seed capsule of claim ¹~~77~~ wherein material of said ^{soil conditioning} materials
~~fines~~ are comprised of ^{sludge or fly ash} industrial byproduct.

³
~~80.~~ The combination seed capsule of claim ²⁹¹~~79~~ wherein the material is a
^{fiber containing} byproduct of a paper making process.

⁴
~~81.~~ The combination seed capsule of claim ⁸⁰³~~79~~ wherein the byproduct is paper
sludge.

52
P. 91

82. The combination seed capsule of claim 79 wherein the byproduct is fly ash.

5
83. The combination seed capsule of claim 77 wherein the material ^{soil conditioning} fines is comprised of municipal sewage.

6
84. The combination seed capsule of claim 78 wherein the material ^{soil conditioning} fines are comprised of ~~grassy/woody substances~~ ^{sawdust}.

Sub C
A'

85. A combination seed capsule comprising;
~~at least one viable seed; said seed acting as a core or pseudo-core of said combination seed capsule;~~
a coating of a composition comprising material ^{soil conditioning} fines;
said coating being applied to said viable seed by a ~~lifting and mixing~~ ^{an} agglomeration operation.

8
86. The combination seed capsule of claim 85 wherein material of said material ^{soil conditioning} fines are comprised of ~~industrial byproduct~~ ^{sludge or fly ash}.

9
87. The combination seed capsule of claim 86 wherein the material is a ^{fiber containing} byproduct of a paper making process.

10
88. The combination seed capsule of claim 86 wherein the byproduct is paper sludge.

89. The combination seed capsule of claim 86 wherein the byproduct is fly ash.

11
90. The combination seed capsule of claim 85 wherein the material ^{soil conditioning} fines is comprised of municipal sewage.

12
91. The combination seed capsule of claim 85 wherein the material ^{soil conditioning} fines are comprised of ~~grassy/woody substances~~ ^{sawdust}.

~~13~~
~~92.~~

The combination seed capsule of claim ~~85~~⁷ wherein a binder is applied to said seed capsule.

14
~~93.~~

The combination seed capsule of claim ~~85~~¹³ wherein a fertilizer is part of said ^{soil conditioning} material ^s fines, said binder or its own layer.

A

94. The combination seed capsule of claim 92 wherein said binder contains lignin.

95. A method of making seed capsules by an agglomeration operation comprising;
spraying a binder on said seed;
lifting and mixing said seeds with material fines.

96. The method of claim 95 wherein said seed capsules are coated with a growth enhancer.

97. The method of claim 96 wherein said growth enhancer is dicalcium phosphate. B

98. The method of claim 95 wherein said material fines are comprised of industrial byproduct fines.

99. The method of claim 95 wherein said binder is a liquid fertilizer.

100. The method of claim 95 wherein said binder contains lignin.

Response to Office Action

Applicant has canceled the original claims in the application and has added new claims 76-100. Applicant's attorney had a telephone interview with the examiner which discussed the use of dicalcium phosphate as a seed coating, and that this was not described in the prior art presently before the Examiner.

54
P. 93

Attached
8



**Granulation and Agglomeration by Fluidized Bed
and Spray Drying Technology**

DR. SVEND HOVMAND

NIRO ATOMIZER INC.

INTRODUCTION

The methods to be described do not involve any mechanical agitation or compaction of the powder to be agglomerated but are agglomeration techniques derived from fluid bed dryer and spray dryer technology. With these methods, the drying and agglomeration of a product can be combined in one step in many cases. The agglomerated or granulated products from a Fluid Bed Granulator or Fluidized Spray Dryer are normally less dense and more fragile than the products agglomerated by the methods described previously in this course; however, stable and well defined agglomerates or granulates, that easily disperse in water can be produced in many applications without the addition of binder. The technology of coating particles in a fluid bed will also be described.

} (circled)

An overview of the techniques described here can be presented as follows:

The starting materials can influence the product characteristic. Granulation is initiated by formulation of liquid bridges. Accordingly, increasing particle surface area and absorption of water result in incomplete wetting of the surface of the particles and this will therefore result in decreasing granule size.


Granule size is directly proportional to droplet size for a given binder solution and varying the droplet size might therefore be the most suitable way of controlling the granule size.

The atomization of the liquid binder can either be performed by pressure nozzles or two fluid nozzles. Two fluid nozzles are often preferred in batch operations as they reduce the tendency to form wet agglomerates and of blockage of the nozzles. Further the position of the nozzle is an important parameter in the granulation process. Nozzles can be placed above the fluidized layer spraying downward, in the side of the fluidized layer, or at the bottom of fluidized layer near the distributor spraying upwards. Each position has advantages and disadvantages, however, no clear conclusions can be drawn from the available literature.

After granulation the granules can be dried in the fluid bed at elevated inlet gas temperatures in order to reduce the drying time.

C. Batch Fluid Bed Coating

Following the drying, the granules can be conveniently spray coated in the same equipment, as experience has shown that the fluidized bed is ideal for spray coating and is giving constant and reproducible coatings of the granules. Fluid



bed coating is an extreme example of fluid bed granulation. The layering mechanisms are made to dominate totally by applying very low liquid feed rates and keeping the fluidized layer dry; thus the drying rate rapid (16), (17), (18).

Coating is important in a number of industries such as pharmaceutical, agrochemical, seed treatment, food, and confectionery.

The reasons for coating are usually:

- appearance
- taste masking
- moisture protection or isolation from other ingredients
- enteric coating
- sustained release
- gastric release

The ideal fluid bed coater will ensure an even coating of each discrete granule/tablet's surface and thus ensure a perfect mix of the particles throughout the whole fluidized layer, by avoiding any dead zones in the fluid bed coater. It is crucial that each particle to be coated passes through the spray zone, preferably without being in contact with other particles and that the applied polymer is dried as rapidly as possible to prevent superficial sticking and picking off one surface to another.

The Wurster Process, Fig. 6, a spray coating process in a fluid bed where the granules are circulated up through the center while being coated, has specially being developed for coating of small and medium sized granules (10) (19).

**Briquetting, Pelletizing, Extrusion
& Fluid Bed/Spray Granulation
April 20-23, 1998
Chicago, IL**

TABLE OF CONTENTS

	SECTION
Selection of the Proper Agglomeration Process	A
Fundamentals of Agglomeration.....	B
Cost of Agglomeration.....	C
Pressure Agglomeration.....	D
The Pelletizing of Chemicals and Industrial Products	E
Granulation by Extrusion and Shaping by Spheronization.....	F
Granulation and Agglomeration by Fluidized Bed and Spray Drying Technology	G
Pelletizing.....	H
Laboratory Testing: Agglomerate Strength	I*
Binders	J*
Appendix	K*

***Optional Day Notes To Be Distributed**

Optional Reading

Koerner, Robert M. and John MacDougall. *Elements II, Briquetting and Agglomeration.*
Hudson: Institute for Briquetting and Agglomeration.



TABLE B-52 Size-Enlargement Methods and Applications*

Method	Equipment	Representative applications
Pressure compaction	Piston or molding press	Plastic preforms, small machine parts (from metal powders (cams, gears, gaskets), metal borings and turnings Pharmaceuticals, catalysts, industrial chemicals, ceramics, metal powders Clay-type minerals, potassium chloride, sodium chloride, organic compounds, metal powders, ores, charcoal, lime, magnesia, titanium sponge, phosphate rock Pharmaceuticals, plastics, clays, carbon, charcoal, industrial chemicals, fertilizers, rubber products, animal feeds Nauxite, plastics, rare-earth fluorides, clays, catalysts Fertilizers, iron ores, nonferrous ores, mineral and clay products, carbon black, various finely divided solid-waste products Fertilizers, premixing (or balling), conditioning steel-plant fines "Instant" foods, detergent granulation Ferrous and nonferrous ores, minerals, cement clinker, solid-waste products Sulfur slates, urea, ammonium nitrate, caustic, various resins, hot-melt adhesives Instant foods, washing powders, dyestuffs, press feeds Urea, ammonium nitrate, resins, coal-tar pitch, etc. Fertilizers, clays, sulfur, nuclear and other wastes Clays, diatomaceous earths, starch, waste by-products Coal fines, soot and oil removal from water Metal dicarbide spheroids Waste sludge, mud and clay slurries, sewage sludge
	Tableting press	
	Roll-type press	
	Pellet mill	
	Screw extruder	
Tumbling and mixer agglomeration	Inclined pan or disk; rotary-drum agglomerator	
	Paddle mixer; horizontal pan	
	Powder blenders; flow-jet mixing	
Thermal processes	Sintering and heat hardening in traveling grate, rotary kiln, grate-kiln, shaft furnace	
	Drying and solidification in drum dryers, ovens, endless-belt systems	
	Spray methods	
Liquid systems	Spray dryers	
	Prilling towers	
	Fluidized and spouted beds	
	Flash dryers	
Liquid systems	Immiscible-liquid wetting in various high-shear and turbine mixers	
	Sol-gel process in spray column	
	Pellet flocculation in drums and stirred vessels	

*Cf. Browning, *Chem. Eng.*, 74(25), 147 (1967).

From Ref. 7

PERRY'S CHEMICAL ENGINEERS' HANDBOOK

SIXTH
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University of Kansas

STRENGTH OF AGGLOMERATES 8-61

TABLE 8-52 Size-Enlargement Methods and Applications*

Method	Equipment	Representative applications
Pressure compaction	Piston or molding press	Plastic preforms, small machine parts from metal powders (cams, gears, gaskets), metal borings and turnings Pharmaceuticals, catalysts, industrial chemicals, ceramics, metal powders Clay-type minerals, potassium chloride, sodium chloride, organic compounds, metal powders, ores, clarecoal, lime, magnesia, titanium sponge, phosphate rock Pharmaceuticals, plasters, clays, carbon, charcoal, industrial chemicals, fertilizers, rubber products, animal feeds Bauxite, plastics, rare-earth fluorides, clays, catalysts
	Tableting press	
	Roll-type press	
	Pellet mill	
Tumbling and mixer agglomeration	Screw extruder	Fertilizers, iron ores, nonferrous ores, mineral and clay products, carbon black, various finely divided solid-waste products Fertilizers, premixing for balling, conditioning stock-plant fines "Instant" foods, detergent granulation Ferrous and nonferrous ores, minerals, cement clinker, solid-waste products Sulfur dyes, urea, ammonium nitrate, caustic, various resins, hot-melt adhesives
	Inclined pan or disk; rotary-drum agglomerator	
	Paddle mixer; horizontal pan	
	Powder blenders; bow-jet mixing	
Thermal processes	Sintering and heat hardening in traveling grate, rotary kiln, grate-kiln, shaft furnace	Infant foods, washing powders, dyestuffs, press feeds Urea, ammonium nitrates, resins, coal-tar pitch, etc. Fertilizers, clays, sulfur, nuclear and other wastes Clays, diatomaceous earths, starch, waste by-products Coal fines, snot and oil removal from water
	Drying and solidification in drum dryers, bakers, endless-belt systems	
Spray methods	Spray dryers	Metal dicarbide spheroids Waste sludge, mud and clay slurries, sewage sludge
	Fluidized and spouted beds	
Liquid systems	Flash dryers	
	Immiscible-liquid wetting in various high-shear and turbine mixers Sol-gel process in spray column Pellet flocculation in drums and stirred vessels	

* Cf. Browning, *Chem. Eng.*, 74(25), 147 (1967).

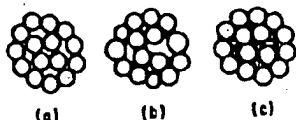


FIG. 8-64 Three states of liquid content for an assembly of spherical particles. (a) Pendular state. (b) Funicular state. (c) Capillary state. [Newitt and Conway-Jones, *Trans. Inst. Chem. Eng. (London)*, 36, 422 (1958).]

Calculation of Agglomerate Strength For an agglomerate composed of equal-sized spherical particles, the tensile strength t is [Rumpf, in Knopper (ed.), *Agglomeration*, op. cit., p. 379]

$$t = \frac{9}{8} \left(\frac{1 - \epsilon}{\pi X^2} \right) NF \quad (8-38)$$

where X is the particle diameter; F is the bonding force per point of contact; N is the mean coordination number, i.e., average number of points of contact between one sphere and its neighbors; and ϵ is the volume fraction of voids in the agglomerate. Values of X and ϵ can be obtained from a size-distribution analysis of the powder and the bulk density of the packed particles. As an approximation, the coordination number N is π/ϵ (Rumpf, loc. cit.) or $N = 2 \exp 2.4(1 - \epsilon)$ [Metsner, *Ind. Eng. Chem. Process Des. Dev.*, 3, 202 (1964)]. For mobile liquid binders in the pendular state

$$t = 2.8 \left(\frac{1 - \epsilon}{\epsilon} \right) \frac{\sigma}{X f(\delta)} \quad (8-39)$$

where σ is the surface tension of the binding liquid and $f(\delta)$ is a function of the angle of contact [Newitt and Conway-Jones, *Trans. Inst. Chem. Eng. (London)*, 36, 422 (1958)].

If wetting is complete, $f(\delta) = 1$. For the capillary state

$$t = 8.0 \left(\frac{1 - \epsilon}{\epsilon} \right) \frac{\sigma}{X f(\delta)} \quad (8-40)$$

The tensile strength of an agglomerate in the pendular state is about one-third of that in the capillary state, while the funicular state has intermediate strengths. A decrease in particle size and porosity yields greater strength. To improve agglomerate strength, the importance of correct particle-size distribution in attaining minimum porosity should be recognized [Ridgway and Tarbuck, *Chem. Process Eng. (February 1968)*].

For the other binding mechanisms calculated values of tensile strength shown in Fig. 8-65 indicate the strength to be expected in various size-enlargement processes.

Strength-Testing Methods Concepts of fracture mechanics (see subsection "Properties of Solids") are applicable to the methods of testing the strength of agglomerates.

Compression tests, in which agglomerates are crushed between parallel platens, are used for quick production checking. Various means of distributing the applied force uniformly over the agglomerate surface are used, including shaving off opposite sides, firing them with hardening plastic, or covering the platen surface with compressive board.

A log-log plot of load at failure against pellet diameter for approximately spherically pellets produced under the same conditions often yields a straight line with slope approximately equal to 2. The intercept of such a plot at unit diameter yields a compressive-strength factor.

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material assed over g product e size pur- or product. nperatures r. arabac, icum, and or attrition used. Attrit-

ng of ores, as in the agents such

Interfacial ished in an (Fig. 8-64). rings at the ate. As the continuous ular state. etely filled, uid bridge ve adhesion

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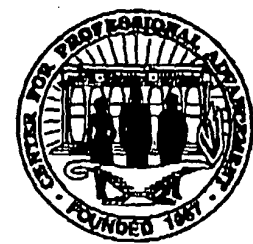
ing the agi- it is prob- most cases.

**The CENTER for
PROFESSIONAL ADVANCEMENT**
 144 Tices Lane, East Brunswick, New Jersey 08816
 Academic Center, Two Tower Center, Ninth Floor,
 New Jersey Turnpike (Exit 9), East Brunswick, New Jersey 08816
Administrative Offices
 Telephone 908-238-1600 • FAX 908-238-9113 • Telex 139303 (CENPRO EBRW).

**Briquetting,
Pelletizing, Extrusion and Fluid
Bed/Spray Granulation**

MARCH 27-29, 1995
 East Brunswick, NJ

W.H. ENGELLEITNER
 Course Director



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 P. 101
 P. 101

Table 23. Review of the most important size enlargement processes and some of their typical applications

Technology	Method	Applications (typical)
Tumble agglomeration	Balling drum, pan, and cone	Iron ores, other ores, cement raw mix, fertilizers, dusts from dust collectors, fine particulate waste materials, ceramics, clay, finely divided minerals, etc.
	Mixer	Ceramic materials, fertilizers, minerals, chemicals, pharmaceuticals, foodstuffs, detergents, etc.
	Fluidized bed (gas)	Fertilizers, pharmaceutical materials, filter cakes, foodstuffs, chemicals
	Suspension (liquid)	Solids, e.g. coal, from suspensions
Induration	Shaft furnace	Iron ores, other ores, minerals, waste materials, e.g. metal-bearing dusts, etc.
	Rotary kiln	
	Straight grate	
	Grate-Kiln Calciners	
Pressure agglomeration	Extrusion presses	Coals, ceramic materials, clays, polymers, plastics
	Pelleting machines	Animal feeds, rubber raw materials, catalysts, lubricants, stabilizers, pigments, polymers, clay, chemicals, pharmaceutical products, insecticides, herbicides, fungicides, etc.
	Piston presses (tableting)	Pharmaceutical products, catalysts, metal powders, ceramic materials, chemicals, pigments, plastic powders
	Roller presses (briquetting, compacting)	Coals, coke, salts, minerals, ores, fertilizers, chemicals, metal powders, animal feeds, polymers, refractories, waste materials, metal-bearing fines, pharmaceutical products, sponge iron, etc.
	Other agglomeration methods	
Agglomeration by heat	Agglomeration by heat	Ores, specifically iron ores, metal-bearing wastes and dusts, mill scale, etc.
	Spray solidification	Urea, other fertilizers, pitches, asphalt, waxes, resins, sulfur, inorganic salts, etc.
	Direct capillary action	Powders, chemicals, coal (spherical agglomeration)
	Alternative sources of particle movement	Finely divided particulate solids, pharmaceuticals, chemicals, food extracts (instant characteristics)
	Coating techniques	Pharmaceuticals, food, fertilizers and agricultural chemicals (control of release), microencapsulation of pigments, etc.
	Flocculation in gases and liquids	Environmental protection, aggregation of solids in gases, flocculation of solids in liquids, selective flocculation, etc.

Table 24. Wanted and unwanted agglomeration in various processes

Product area	Process	
	Wanted	Unwanted
Aggregate (+ 3 mm)	Briquetting, compacting + crushing and screening	—
Agricultural chemicals	Tumble agglomeration (disc and drum), mixer agglomeration, briquetting, compacting + crushing and screening	Caking, bag set, build-up, flow problems, segregation due to selective agglomeration
Alumina	Granulation (tumble/pressure), calcining	Build-up, caking, flow problems
Animal feed	Pelleting, mixer agglomeration, briquetting	Caking
Carbon black	Fluid bed, mixer agglomeration, granulation by compaction	Build-up, caking, flow problems
Ceramics	Precipitation, sol-gel, spray drying and granulation, compaction + crushing and screening, tableting	Build-up, caking
(China) clay	Tumble agglomeration, extrusion	Lumping, caking
Coal	Calcining, briquetting, tumble agglomeration, spherical agglomeration	Build-up
Detergents	Spray drying or granulation, micropelletization (drum, disc, mixer), tableting, pelleting	Caking, lumping, build-up
Dust (- 0.5 mm)	Tumble agglomeration (disc, drum, fluid bed), briquetting, compacting, pelletizing (extrusion)	Build-up, caking
Fertilizers	Drum or disc granulation, compaction + crushing and screening, drop solidification	Caking, build-up, bag set
Filter cakes	Tumble agglomeration, briquetting, pelleting	Caking
Fumes (micrometer and submicrometer)	Fluid bed (with and without binder), disc and drum agglomeration	Build-up, caking, flow problems

(continued)

several types of agglomeration equipment can be identified. A description and list of equipment for each method follows:

Agitation methods are characterized by tumbling or particle-growth mixing, usually in the presence of a liquid. Available equipment includes disc pelletizers, drum pelletizers, cone pelletizers, paddle mixers, plow mixers, mixer-millers, mixer-granulators, pin mixers, coating pans, vertical mixers, cone blenders, vibrating screens, and vibrating conveyor-processors.

Pressure methods are characterized by force, as with compaction techniques. Available equipment includes briquetters, compactors, extruders, pellet mills, tableting machines, and isostatic compaction presses.

Thermal methods are characterized by applied heat, as in sintering or fusion and melt crystallization techniques. Available equipment includes heat-hardening devices, sinter strands or grates, indurating kilns, nodulizing kilns, drying and solidifying equipment, drum dryers, belt dryers, and hot-melt drum or pan granulators.

Liquid methods are characterized by spray or fluid bed agglomeration and agglomeration from liquid media. Available equipment includes spray dryers, prilling towers, spray granulators, and immiscible liquid-wetting devices.

Selection Factors for Choosing an Agglomeration Method

Selecting an agglomeration process or method depends on several factors, including the kind of raw material, the type of equipment, the intended use of the end product or agglomerate, and the use of a binder or binders. In many cases, there is a trade-off or compromise not necessarily determined by one factor alone.

Kind of Raw Material

In some instances, the selection of a method can be entirely dependent on the raw material's size or size range and uniformity of size. For example, a raw material that is 100 percent minus 325 mesh has different process requirements than a granular-fine stream ranging from 10 mesh to 325 mesh with a uniform size distribution curve.

The material's feed moisture, bulk density, angle of repose, flow characteristics, chemical composition, and toxicity can also effect the selection process. Table 1 lists the material characteristics of typical agglomerator feed streams, as well as the agglomeration methods suitable for these materials. The table shows the influence of the condition, size, handling characteristics, and moisture content of the raw material on process selection.

It should be noted, however, that there are exceptions to these guidelines. For instance, a pasty material may have to be extruded to utilize the flowability, viscosity, and moldability characteristics of the material as it flows through the auger and extruder die. In another case, a relatively coarse, but dry feed-

stock with the consistency of sand may not be pelletized by agitation and pellet growth alone; pressure, induced by a double-roll briquetter, may be required to compact the particles. Other feed materials, such as wood chips, are elastic and, at times, have a rather amorphous shape and size. Pelletizing and briquetting are poor agglomeration choices for these materials. A pellet mill or pellet press that applies pressure and friction and has a certain retention time in the die is a better choice.

In many cases, it is necessary to test a representative sample of a particular material in the laboratory before one or several agglomeration methods can be selected. Regardless of whether there is a previous application history, many materials are somewhat different, even within the same species, and should be tested.

Type of Equipment

The selection of an agglomeration method may not involve as wide a range of possibilities and variables as the field of equipment suggests. (See Table 2) When selecting agglomeration equipment, the processes before, during, and after the actual particle size enlargement step must also be considered. The total system, including storing feed, metering, proportioning, conveying, pretreating, binder-

Method	Maximum Capacity (tph)	Retention Time	Typical Applications
Briquetter	50	seconds	Coal, Lime, Magnesia
Compactor-Granulator	75	seconds	Fertilizer, Peat, Salt
Extruder (Auger, Screw)	30	5-10 min.	Clay, Foods, Plastics
Flexible Mixer-Agglomerator	40	seconds	Chemicals, Flue Dust
Fluid Bed Granulator	30	1-10 min.	Chemicals, Foods, Pharmaceuticals
Mixer-Granulator	10	+30 min.	Ceramics, Chemicals
Nodulizing Kiln	1,000	+30 min.	Cement, Lime, Oras
Pelletizer (Disc, Drum)	100	1-5 min.	Coal, Flue Dust
Pellet Mill	50	1-5 min.	Biomass, Plastics
Pin Mixer	25	0-5 min.	Carbon Black, Chemicals, Flue Dust
Piston Press (Ram Extruder)	5	1-10 min.	Metal chips or fines
Prill Tower	30	0-5 min.	Nitrate, Sulfur, Urea
Pugmill	300	5-10 min.	Clay, Fertilizer, Fly Ash
Sinter Strand	1,000	+30 min.	Ferrous & Nonferrous Ores
Zig-Zag Blender	30	1-10 min.	Ceramics, Chemicals, Flue Dust

*Batch units: 0.5-1 tph
*Retention time = 1 sec.

adding, product handling, post-treating, screening, packaging, and shipping can influence the selection of an agglomeration device.

For example, almost all continuous agglomeration equipment requires a uniform and controllable feed, by either a volumetric or

ft. height, if the actual handling of the product is reasonable, not severe, and the end use is feedstock within the plant?

The physical specifications for some agglomerates are very strict, particularly if industry practice, market standards, or competitive pressures require adherence to a code. For instance, iron ore pellets, compacted potash granules, molecular sieves, catalyst supports, and metal briquettes for furnace charge require very high product strength. On the other hand, many other agglomerates have no fixed or known standards. A realistic basis for determining the desired physical specifications reduces investing and operating costs and makes the task of the equipment supplier and test engineer much easier.

Binder Use

Binderless agglomeration, using only the natural or induced bonding forces of the particulate and the optimum densification (packing) at lowest porosity, is the most desirable and economical agglomeration method. If a liquid needs to be added to induce particle flow and compaction, water is the first choice. If binderless agglomeration or water alone cannot produce a permanent bond with high tensile strength, then additional binder materials must be added to increase the final product strength.

The method of binder classification first proposed by P.L. Waters⁴ and further described by K.R. Komarek,⁵ distinguishes binders by type, physicals, function, and chemical composition. Binder materials are either liquid (water, alcohol, oil, silicate, acid), solid (clay, dry starch, bentonite) or semi-solid (tar, pitch). Some binders act upon the product as film between solid particles (water, starch, silicate); others act as a matrix, filling voids between the particulates and becoming part of the dense mass of the agglomerate (tar, pitch). Those classified as chemical binders rely on the chemical reaction within the binder upon curing or heating, or between the binder and the raw material. Two binders can also be added—such as cement and water, lime and water, and lime and molasses—to produce a chemical reaction and induce bonding strength in the agglomerate.

The use of a binder is often limited by the specifications of the agglomerate. Some agglomerates can or cannot use organic binders, inorganic binders, or binders containing ash-form constituents, sulphur, or toxic materials. Cost can also limit the use of a binder. The purchase cost can make the use of an otherwise excellent binder uneconomical, or the transportation cost may be higher than the binder cost at origin.

When selecting a binder, emphasis should be placed on the proper test procedures. The selection of a binder can influence the agglomerate's post-treatment process, including

the type of equipment to be used for curing, drying, heating, and firing.⁶ For the best results, laboratory results should be optimized and bench-tests qualified with at least one larger run in a prototype machine.

Wrapping Up the Selection Process

As this article has shown, selection of the proper agglomeration method and equipment depends on the characteristics of the raw material, the limitations of the equipment, the specifications of the desired agglomerate, and, in some instances, the choice of a binder or binders.

To help make process comparison and selection easier once this information is known, it is also useful to: study prior agglomeration applications for the same or similar raw material; review technical documentation on agglomeration methods or types of equipment made by professional societies, industry trade groups, or independent research organizations; consult industry standards on agglomerate product quality; and, compare vendor information and budget proposals. **CEES**

Endnotes

1. W.H. Engelleitner, *Selection of the Proper Agglomeration Process*, XVII, Institute for Briquetting & Agglomeration (1981).
2. W. Pietsch, "Pressure Agglomeration, The State of The Art," *Agglomeration*, 2, AIME (1977).
3. *Ibid.*
4. P.L. Waters, *Briquette Binders, A Reappraisal*, XII, Institute for Briquetting & Agglomeration, (1971).
5. K.R. Komarek, "Selecting Binders and Lubricants for Agglomeration Processes," *Chemical Engineering*, (1987).
6. J. MacDougall and V. Vellella, "Elements II: Briquetting and Agglomeration," Introduction, Institute for Briquetting and Agglomeration, (1983).



W.H. Engelleitner is a consultant specializing in agglomeration technology. He has more than twenty-five years experience in particle size enlargement by pelletizing, pressure compaction, extrusion, and other methods. Mr. Engelleitner is an executive and past president of the Institute for Briquetting and Agglomeration, a member of the Society of Mining Engineers, and a lecturer on briquetting, pelletizing, and extrusion at the Center for Professional Advancement, East Brunswick, NJ. In addition, he has authored many papers on agglomeration technology and holds several patents in this field. Mr. Engelleitner is currently manager of agglomeration for Teledyne Readco, York, PA.

For more information contact:

TELEDYNE READCO

901 South Richmond Avenue
York, PA 17403
717/469-2201 Telex: 84-0432

Equipment and Systems for Mixing and Agglomeration

UT Ex. 2025

SteadyMed v. United Therapeutics

IPR2016-00006

12/15/99 *CAV 1649/1#*
#7

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Madigan

SERIAL NO.: 09/113,254

FILED: July 10, 1998

FOR: SEEDING TREATMENTS



ART UNIT: 1649

EXAMINER: Grunberg

RECEIVED
DEC 21 1999
TECH CENTER 1600/2900

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

PETITION FOR EXTENSION OF TIME

Applicants hereby petition the commissioner that the time now set for responding to the Official Action of June 18, 1999, be extended for three months to expire on December 18, 1999.

Our check for \$435.00 is enclosed to cover the extension fee set in 37 CFR §1.136. A duplicate copy of this petition is enclosed.

Respectfully submitted,

Per: *Philip M. Weiss*
Philip M. Weiss
Reg. No.: 34,751

12/16/1999 NPRASASD 00000037 09113254

01 FC:217

435.00 OP



APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
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09/113,254

EXAMINER

ART UNIT	PAPER NUMBER
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6 1/2

DATE MAILED:

INTERVIEW SUMMARY

All participants (applicant, applicant's representative, PTO personnel):

- (1) Anne Marie Grünberg (3) _____
 (2) Philip Weiss (4) _____

Date of Interview 12/1999

Type: Telephonic Personal (copy is given to applicant applicant's representative).

Exhibit shown or demonstration conducted: Yes No If yes, brief description: _____

Agreement was reached. was not reached.

Claim(s) discussed: _____

Identification of prior art discussed: _____

Description of the general nature of what was agreed to if an agreement was reached, or any other comments: _____

Philip Weiss, attorney for applicant, called to determine whether a declaration was appropriate. The examiner felt that a declaration at this time was not necessary, but art supporting definitions may be helpful.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign this form unless it is an attachment to another form.

Anne Marie Grünberg

Manual of Patent Examining Procedure, Section 713.04 Substance of Interview must Be Made of Record

A complete written statement as to the substance of any face-to-face or telephone interview with regard to an application must be made of record in the application, whether or not an agreement with the examiner was reached at the interview.

§1.133 Interviews

(b) In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for response to Office action as specified in §§ 1.111, 1.135. (35 U.S.C.132)

§ 1.2. Business to be transacted in writing. All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete a two-sheet carbon interleaf Interview Summary Form for each interview held after January 1, 1978 where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks in neat handwritten form using a ball point pen. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below.

The Interview Summary Form shall be given an appropriate paper number, placed in the right hand portion of the file, and listed on the "Contents" list on the file wrapper. The docket and serial register cards need not be updated to reflect interviews. In a personal interview, the duplicate copy of the Form is removed and given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephonic interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the telephonic interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Serial Number of the application
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (personal or telephonic)
- Name of participant(s) (applicant, attorney or agent, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the claims discussed
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). (Agreements as to allowability are tentative and do not restrict further action by the examiner to the contrary.)
- The signature of the examiner who conducted the interview
- Names of other Patent and Trademark Office personnel present.

The Form also contains a statement reminding the applicant of his responsibility to record the substance of the interview.

It is desirable that the examiner orally remind the applicant of his obligation to record the substance of the interview in each case unless both applicant and examiner agree that the examiner will record same. Where the examiner agrees to record the substance of the interview, or when it is adequately recorded on the Form or in an attachment to the Form, the examiner should check a box at the bottom of the Form informing the applicant that he need not supplement the Form by submitting a separate record of the substance of the interview.

It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview:

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner. The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he feels were or might be persuasive to the examiner,
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete or accurate, the examiner will give the applicant one month from the date of the notifying letter or the remainder of any period for response, whichever is longer, to complete the response and thereby avoid abandonment of the application (37 CFR 1.135(c)).

Examiner to Check for Accuracy

Applicant's summary of what took place at the interview should be carefully checked to determine the accuracy of any argument or statement attributed to the examiner during the interview. If there is an inaccuracy and it bears directly on the question of patentability, it should be pointed out in the next Office letter. If the claims are allowable for other reasons of record, the examiner should send a letter setting forth his or her version of the statement attributed to him. If the record is complete and accurate, the examiner should place the indication "Interview record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

GROUP 1600

Please type a plus sign (+) inside this box --

REVOCAION OF POWER OF ATTORNEY OR AUTHORIZATION OF AGENT	Application Number	08/113,254
	Filing Date	July 10, 1998
	First Named Inventor	Madigan
	Group Art Unit	1848
	Examiner Name	A. Grunberg
	Attorney Docket Number	29214

I hereby revoke all previous powers of attorney or authorizations of agent given in the above-identified application:

A Power of Attorney or Authorization of Agent is submitted herewith.

OR

Please change the correspondence address for the above-identified application to:

Customer Number



Place Customer Number Bar Code Label here

OR

<input checked="" type="checkbox"/> Firm or Individual Name	Weiss & Weiss Attn: Philip M. Weiss				
Address	500 Old Country Road				
Address					
City	Garden City				
Country	U.S.A.	State	New York	Zip	11530
Telephone	518-739-1500	Fax	518-739-2189		

I am the:

Applicant.

Assignee of record of the entire interest
Certificate under 37 CFR 3.73(b) is enclosed

SIGNATURE of Applicant or Assignee of Record

Name	Fesco International by Daniel Madigan
Signature	<i>Daniel P. Madigan</i>
Date	10/20/99

511/07205.01
101389/2231/50054.00001

OCT-18-1999 12:19

P.04/04

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Madigan**Group Art No: 1649****Serial No.: 09/113,254****Attorney:****Filed: July 10, 1998****For: SEEDING TREATMENTS**

BOX RESPONSES NO FEE
Assistant Commissioner for Trademarks
2800 Crystal Drive
Arlington, VA 22202-3513

**POWER OF ATTORNEY AND APPOINTMENT
 OF DOMESTIC REPRESENTATIVE**

Sir.

Applicant hereby appoints Philip M. Weiss, Reg. No. 34,761; attorney of the firm WEISS & WEISS, located at 500 Old Country Road, Garden City, New York 11530, to prosecute this application to register, to transact all business in the Patent and Trademark Office in connection therewith and to receive the Certificate of Registration.

Philip M. Weiss, Esq., of Weiss & Weiss, whose postal address is 500 Old Country Road, Garden City, New York 11530, Telephone (516) 739-1500, is hereby designated as applicant's representative upon whom notices or process in proceedings affecting the mark may be served.

Respectfully submitted,

Feeco International

By: WEISS & WEISS

Per.

Daniel P. Madigan
 Daniel Paul Madigan
 3913 Algoma Road
 Green Bay, WI 54311

811/87286.01

TOTAL P.04

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GRAHAM & JAMES LLP

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Foeco International

Application No./Patent No.: 09/113,254 Filed/Issue Date: July 10, 1998

Entitled: SEEDING TREATMENTS

Foeco International a Corporation
(name of Assignee) (Type of Assignee e.g., corporation, partnership, university, government agency, etc.)

states that it is:

- 1. the assignee of the entire right, title, and interest; or
- 2. an assignee of an undivided part interest

In the patent application/patent identified above by virtue of either:

A. An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the Patent and Trademark Office at Reel 9831, Frame 0624, or for which a copy thereof is attached;

OR

B. A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as shown below:

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Additional documents in the chain of title are listed on a supplemental sheet.

Copies of assignment or other documents in the chain of title are attached.
NOTE: A separate copy (i.e., the original assignment document or a true copy of the original document) must be submitted to Assignment Division in accordance with 37 CFR part 3, if the assignment is to be recorded in the records of the PTO. See MPEP 302-302.8

The undersigned (whose title is supplied below) is empowered to sign this statement on behalf of assignee.

Date

Daniel P. Madigan
Signature
Daniel P. Madigan
Type or print name
President
Title

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WEISS & WEISS

Attorneys At Law

500 Old Country Road, Suite 305, Garden City, NY 11530
Phone No. 516-739-1500 / Fax No. 516-739-2189

TO:

Ann Marie Grunberg

FAX NO.

703-308-4242

DATE:

October 28, 1999

FROM:

Philip M. Weiss, Esq.

FAX NO.

(516) 739-2189

NUMBER OF PAGES (INCLUDING COVER SHEET):

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Washington, D.C. 20231

APPLICATION NO. 09/113,254	FILING DATE 07/18/98	FIRST NAMED INVENTOR MADIGAN	ATTORNEY DOCKET NO. 29214
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HM22/0618

THOMAS D WILHELM
WILHELM LAW SERVICE
100 W LAWRENCE STREET
THIRD FLOOR
APPLETON WI 54911

EXAMINER GRUNBERG, A

ART UNIT 1849	PAPER NUMBER
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DATE MAILED: 06/18/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No. 09/113,254	Applicant(s) Madigan et al.
Examiner Anne Marie Grunberg	Group Art Unit 1649



- Responsive to communication(s) filed on Jul 10, 1998
- This action is **FINAL**.
- Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire three month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

- Claim(s) 1-75 is/are pending in the application.
Of the above, claim(s) 70-73 is/are withdrawn from consideration.
- Claim(s) _____ is/are allowed.
- Claim(s) 1-69, 74, and 75 is/are rejected.
- Claim(s) _____ is/are objected to.
- Claims _____ are subject to restriction or election requirement.

Application Papers

- See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- The drawing(s) filed on Jul 10, 1998 is/are objected to by the Examiner.
- The proposed drawing correction, filed on _____ is approved disapproved.
- The specification is objected to by the Examiner.
- The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
 - All Some* None of the CERTIFIED copies of the priority documents have been
 - received.
 - received in Application No. (Series Code/Serial Number) _____
 - received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

- Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- Notice of References Cited, PTO-892
- Information Disclosure Statement(s), PTO-1449, Paper No(s). 3
- Interview Summary, PTO-413
- Notice of Draftsperson's Patent Drawing Review, PTO-948
- Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

Art Unit: 1649

DETAILED ACTION

The Group and/or Art Unit location of your application in the PTO has changed. To aid in correlating any papers for this application, all further correspondence regarding this application should be directed to Group Art Unit 1649.

Election/Restriction

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1- 69, and 74-75, drawn to a seed capsule and methods of use, classified in class 47, subclass 58.1, for example.
 - II. Claims 70-73, drawn to a method of making capsules, classified in class 47, subclass 57.6, for example.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the capsules can be made by a method involving different sequences of steps than that claimed in Group II.

Art Unit: 1649

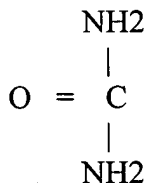
Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification or by their recognized divergent subject matter and because the search required for Invention I is not required in Inventions II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Attorney Thomas Wilhelm on June 8, 1999 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-69, and 74-75.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(I).

3. The disclosure is objected to because of the following informalities:

a. Throughout the specification, as on page 8, lines 22-24, for example, urea is described as inorganic. However urea has the following structure which clearly has a carbon and makes urea an organic substance;



Art Unit: 1649

b. Throughout the specification, as on page 9, lines 5-7, for example, sulfur, magnesium and chromium are characterized as being micronutrients. However, according to Biology of Plants (Raven et al., 1992), sulfur and magnesium are macroelements, and chromium is not listed as a micronutrient.

c. The figures are described in a confusing manner in the specification. For example, on page 19, lines 23-28, Figure 1 and 2 are said to contain a numbered "12", "14", and "16". However, Figure 1 does not seem to contain a "12" or "14", and Figure 2 does not contain a "16". The description of all the figures should be reviewed for such errors.

d. The drawings are objected to because Figure 1 has a number appearing under the labeled number "28" that is unreadable.

Appropriate correction is required. No new matter should be added.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Art Unit: 1649

5. Claims 1-2, 4-5, 7, 9, 12-13, 18, 22, 26-28, 30-31, 33, 35-36, 39, 43, 45-48, 51-52, 54-55, 58, 61-62, and 67-68, and dependent claims 3, 6, 8, 10-11, 14-17, 19-21, 23-25, 29, 32, 34, 37-38, 40, 56-57, 59-60, 63-66, and 69 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 is unduly narrative in the recitation of “having an outer surface”, and is vague and indefinite in the recitation of “mounted proximate, including disposed outwardly of the outer surface”. It is unclear what the object of “mounted” is, nor is it clear what the second part of the phrase is referring to.

Claims 2, 28, 43, and 55 are vague and indefinite in the recitation of “enhancing”, “reducing”, “affects”, and “assisting”. This rejection may be obviated by changing the above to --enhanced--, --reduced--, --effects--, and --assistance--. Additionally, “ones of” is unclear (line 1 of iv.), and “flight” gives the impression that the seeds can fly. Since “flight” does not seem to be defined in the specification, it should be deleted.

Claim 4 is vague and indefinite in the recitation of “affect” as it is unclear what is intended. This rejection may be obviated by inserting --effects-- in its stead.

Claims 4 and 7 are vague and indefinite in the recitation of “animals, weeds, and spore-formers” for employing improper Markush terminology. See MPEP 2173.05(h). This rejection may be obviated by changing the phrase to --animals, weeds, or spore-formers.--

Art Unit: 1649

Claim 5 is vague and indefinite in the recitation “bitter substance”. This terminology does not appear to be defined in the specification and it is subjective language that is open to interpretation.

Claims 9 and 58 are vague and indefinite in the recitation “and generally displaced from said seed” or “and generally displaced from the seeds” because it is not clear what is meant.

The recitation of “urea” in claim 12 is not in accordance with the term “inorganic” which precedes it. Urea is not an inorganic plant nutrient.

Claim 13 is vague and indefinite in grammatical composition. This rejection may be obviated by inserting --which-- before “is”.

The recitation of “sulfur” and “chromium” in claim 18 is not in accordance with the term “micronutrient”. According to the Biology of Plants (Raven et al., Ed, page 596), sulfur is a macronutrient, and chromium is not listed as a micronutrient.

Claim 22 is vague and indefinite in the recitation of “ones, but less than all”, and in “for germination thereof” which are unduly narrative and confusing. This claim should be reworded to better reflect the intended meaning of the claim.

Claim 26 is vague and indefinite in the recitation of “having a first overall soil condition and texture”, and “disposed outwardly of the outer surfaces of said seeds”. The recitation “having outer surfaces,” and “said coatings of said seed capsules.....in the root zone of said plant growing medium.” is unduly narrative.

Art Unit: 1649

Claim 27 is vague and indefinite in the recitation “until respective ones of said seeds germinate.” It is unclear what “ones” is referring to.

Claims 30-31 are vague and indefinite in the recitation of “affect” or “effect” and “animals, weeds, and spore-formers” for reasons stated above. This rejection may be obviated by changing the above to --effects--, and --animals, weeds, or spore-formers.--

Claims 33 and 45 are vague and indefinite in the recitation “and generally displaced from said seeds” because it is not clear what is meant.

Claims 35 and 61 are vague and indefinite in the recitation of “uncoated ones of”.

Claims 36, 48, and 62 are vague and indefinite in the recitation of “including” which is not U.S. recognized terminology since it is not possible to distinguish whether it is an open or closed term. This rejection may be obviated by replacing “including” with --further compromising--.

Claims 39, 51 and 67 are vague and indefinite in the recitation of “agglomerating said coatings onto said inner layers.” It is unclear how the coatings can be agglomerated onto their own inner layers.

Claim 46 is vague and indefinite in the recitation of “nitrogen, phosphorus, and potassium” which employs improper Markush terminology. This rejection may be obviated by changing the above to --nitrogen, phosphorus, or potassium.--

Claim 47 is vague and indefinite in the recitation of “chromium” Chromium is not a recognized plant nutrient as taught by Biology of Plants (Raven et al., Ed, page 596).

Art Unit: 1649

Claim 52 is vague and indefinite in the recitation of “comprising” which is grammatically incorrect. This rejection may be overcome by deleting “comprising” and inserting --comprises--.

Claim 54 is unduly narrative in part ‘(a)’. It is unclear what applicant is claiming.

Claim 68 is vague and indefinite in the recitation of “the soil conditioners and plant nutrients” which lacks antecedent basis in claims 54. This rejection may be obviated by deleting “the” in line 2 of claim 68.

Clarification is required. No new matter should be added.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-5, 7-10, 12, 14-15, 17, 21, 23-35, 39-41, 43-45, 47-48, 51-59, 61, 63, 66-69, and 74-75, are rejected under 35 U.S.C. 102(b) as being anticipated by Gerber.

Claims 1-5, 7-10, 12, 14-15, 17, 21, 23-35, 39-41, 43-45, 47-48, 51-59, 61, 63, 66-69, and 74-75, are drawn to a combination seed capsule which can be easily broadcast, and which protects the seed from the weather and pests, thus increasing germination rate, and prolonging the

Art Unit: 1649

range during which the seed may germinate. Additionally, the seed capsule may comprise two coats and may contain nutrients, herbicides, pesticides, and a bitter substance. Moisture retaining substances and other additives, enhance the germination microenvironment of the seed and act as a soil conditioner.

Gerber teaches a seed pellet having a core containing seed, organic substrates, loess, organic fertilizers, fungicides, pesticides, and a wetting agent which promotes surface wettability (abstract, first 4 lines). At least one bitter substance may also be present to deter animals from eating the seed capsules (column 4, lines 13-28). A second, outer coat may be applied to the core and should be semipermeable to allow water to penetrate but which keeps the water-soluble constituents from leaving the core (column 4, lines 29-48). The seed capsule inhibits germination during storage (column 7, lines 62-65). The pellets allow an increase in germination to occur (column 6, lines 48-49) and allow seeds to better be dispersed from an airplane (column 7, lines 65-66).

8. Claims 1-5, 8, 19, 21-30, 32, 35, 37, 39-41, 43-44, 47, 49, 51-57, 61, 64, 66-69, and 74-75 are rejected under 35 U.S.C. 102(b) as being anticipated by Roth.

Claims 1-5, 8, 19, 21-30, 32, 35, 37, 39-41, 43-44, 47, 49, 51-57, 61, 64, 66-69, and 74-75 are drawn to a combination seed capsule which can be easily broadcast, and which protects the seed from the weather and pests, thus increasing germination rate, and prolonging the range during which the seed may germinate. Additionally, the seed capsule may comprise two coats

Art Unit: 1649

and may contain nutrients, herbicides, pesticides, and a bitter substance. Moisture retaining substances and other additives, enhance the germination microenvironment of the seed and act as a soil conditioner. Additionally, the soil conditioning material comprises a sludge composition.

Roth teaches a methanol treated activated sludge carrier that acts as a means for sustaining the release of agricultural chemicals and can be used as a seed pelleting composition (abstract). The sludge acts as a carrier for all types of chemicals including pesticides, fertilizers, plant growth regulators, attractants and repellants (column 2, lines 48-52). Compounds such as urea, and iron are discussed in column 3, lines 1-22. Crop seeds are coated with the pelleting composition (column 4, lines 46-48, claims 9, and 16-17) which is stable under adverse weather conditions, and although hydrating in water, does not dissolve and wash off the substrate (column 2, lines 41-44).

It is well known in the art, that seed coatings or encapsulations increase the size of the seed to make broadcasting easier and to improve flowability. Trace elements, nutrients, pesticides, and wettable substances serve to protect the seed and increase germinability, thus increasing the health and survival rate of young plants. Thus, these features are inherent properties of the coated seeds taught by Roth.

9. Claims 1-4, 7-9, 14, 20-21, 24-32, 35,38-45, 47, 50-58, 61, 65-68, and 74-75 are rejected under 35 U.S.C. 102(b) as being anticipated by Nilsson.

Art Unit: 1649

Claims 1-4, 7-9, 14, 20-21, 24-32, 35,38-45, 47, 50-58, 61, 65-68, and 74-75 are drawn to a combination seed capsule which can be easily broadcast, and which protects the seed from the weather and pests, thus increasing germination rate, and prolonging the range during which the seed may germinate. Additionally, the seed capsule may comprise two coats and may contain nutrients, herbicides, pesticides, and a bitter substance. Moisture retaining substances and other additives, enhance the germination microenvironment of the seed and act as a soil conditioner. Additionally, the soil conditioning material comprises a fiber-containing by-product of a paper making operation.

Nilsson teaches a seed germination improving capsule having a water absorbing ability (abstract) which may be made from paper pulp or paper fibers (column 1, lines 60-65). The capsule material may be provided with additives such as nutrients, wetting agents, and germination inhibitors, etc (column 3, lines 18-23) The capsule may also be dyed blue in order to discourage animals from eating them (column 3, lines 23-25). An additional outer material may be applied as a wetting agent (column 3, lines 36-44). Seed capsules disperse well and due to the dispersal properties and protective properties of the seed capsule, not as many seeds need to be dispersed (column 3, lines 26-35, column 6, lines 64-68, table 1 in column 7).

Claim Rejections - 35 USC § 103

Art Unit: 1649

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1-69, and 74-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schreiber in view of Aswell and Roth.

Claims 1-69, and 74-75 are drawn to a combination seed capsule which can be easily broadcast, and which protects the seed from the weather and pests, thus increasing germination rate, and prolonging the range during which the seed may germinate. Additionally, the seed capsule may comprise two coats and may contain a soil conditioning substance, nutrients, herbicides, pesticides, and a bitter substance. Moisture retaining substances and other additives,

Art Unit: 1649

enhance the germination microenvironment of the seed and act as a soil conditioner.

Additionally, the soil conditioning material comprises a sludge composition or a fiber-containing by-product of a paper making operation.

Schreiber teaches a seed having a multiple layered coating (column 3, lines 35-39) in which the outer coating controls water imbibition of the seed to the extent necessary to delay germination until environmental factors are conducive to growth (claim 1).

Schreiber does not teach a combination seed capsule which can be easily broadcast, and contains nutrients, herbicides, pesticides, a bitter substance, and a soil conditioning substance.

Aswell teaches a waste paper soil conditioning and fertilizing pellet (column 1, lines 14-19). The densified pellets have greater water absorption and retention qualities than do most soils (column 3, lines 10-14) and may contain fertilizing ingredients (claims 5, 7).

Roth teaches an activated sludge that acts as an agricultural chemical carrier and suggests its use for seed pellets (abstract), as stated above.

It would have been *prima facie* obvious to a person of ordinary skill in the art at the time the invention was made to use the method of coating seeds as taught by Schreiber, and to modify that method by using the waste paper soil conditioning and fertilizing pellet as taught by Aswell to contain the seeds, given that it would have been obvious to want to fertilize and condition the soil in order to realize healthy seedlings. Additionally, it would have been obvious to use the activated sludge as taught by Roth to plug the hollow pellets taught by Aswell in order to minimize any contact to herbicides included within the capsules, and to increase fertilizing

Art Unit: 1649

(Roth, column 2, lines 25-27) and water retention values. Choice of fungicides, pesticides and animal repellents would have been the optimization of process parameters.

No claim is allowed.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anne Marie Grunberg whose telephone number is (703) 305-0805. The examiner can normally be reached from Monday through Thursday from 7:30 until 5:00, and every other Friday from 7:30 until 4:00.

If attempts to reach the examiner are unsuccessful, the examiner's supervisor, Lynette Smith, can be reached at (703) 308-3909. The fax number for the unit is (703) 308-4242.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0196.

AMG

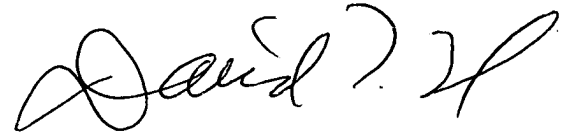
Application/Control Number: 09/113,254

Page 15

Art Unit: 1649

June 16, 1999

DAVID T. FOX
PRIMARY EXAMINER
GROUP ~~180~~ 1649

A handwritten signature in cursive script, appearing to read "David T. Fox".

Notice of References Cited

Application No. 09/113,254	Applicant(s) Madigan et al.	
Examiner Anne Marie Grunberg	Group Art Unit 1649	Page 1 of 1

U.S. PATENT DOCUMENTS

	DOCUMENT NO.	DATE	NAME	CLASS	SUBCLASS
A	4,759,151	7/26/1988	Gerber	47	57.6
B	4,628,633	12/16/86	Nilsson	47	57.6
<i>See FC Form 3</i>	3,269,824	10/25/63 <i>8/1966</i>	Aswell	47	57.6
D	3,698,133	10/17/72	Schreiber	47	57.6
E	4,065,287	12/27/77	Roth	71	13
F					
G					
H					
I					
J					
K					
L					
M					

FOREIGN PATENT DOCUMENTS

	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N						
O						
P						
Q						
R						
S						
T						

NON-PATENT DOCUMENTS

	DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
U	Biology of Plants, Raven et al., Worth Publishers, page 596	1992
V		
W		
X		

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

The drawing(s) filed (insert date) 7-10-98 are:

- A. approved by the Draftsperson under 37 CFR 1.84 or 1.152.
- B. objected to by the Draftsperson under 37 CFR 1.84 or 1.152 for the reasons indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawing must be submitted according to the instructions on the back of this notice.

<p>1. DRAWINGS: 37 CFR 1.84(a): Acceptable categories of drawings: <u>18</u></p> <p>Color drawings are not acceptable until position is granted. Fig(s) _____</p> <p>Pencil and non-black ink not permitted. Fig(s) _____</p> <p>2. PHOTOGRAPHS: 37 CFR 1.84 (b)</p> <p>1 full-tone set is required. Fig(s) _____</p> <p>Photographs not properly mounted (must use bristol board or photographic double-weight paper). Fig(s) _____</p> <p>Four quality (half-tone). Fig(s) _____</p> <p>3. TYPE OF PAPER: 37 CFR 1.84(c)</p> <p>Paper not flexible, strong, white, and durable. Fig(s) _____</p> <p>Erasures, alterations, overwritings, interlineations, folds, copy-machine marks not accepted. Fig(s) _____</p> <p>Mylar, velum paper is not acceptable (too thin). Fig(s) _____</p> <p>4. SIZE OF PAPER: 37 CFR 1.84(f): Acceptable sizes:</p> <p>21.0 cm by 29.7 cm (DIN size A4)</p> <p>21.6 cm by 27.9 cm (8 1/2 x 11 inches)</p> <p>All drawing sheets not the same size.</p> <p>Sheet(s) _____</p> <p>Drawings sheets not an acceptable size. Fig(s) _____</p> <p>5. MARGINS: 37 CFR 1.84(g): Acceptable margins:</p> <p>Top 2.5 cm Left 2.5cm Right 1.5 cm Bottom 1.0 cm</p> <p>SIZE: A4 Size</p> <p>Top 2.5 cm Left 2.5cm Right 1.5cm Bottom 1.0cm</p> <p>SIZE: 8 1/2 x 11</p> <p>Margins not acceptable. Fig(s) <u>13, 560</u></p> <p>Top (T) _____ Left (L) _____</p> <p>Right (R) _____ Bottom (B) _____</p> <p>6. VIEWS: 37 CFR 1.84(h)</p> <p>REMINDER: Specification may require revision to correspond to drawing changes.</p> <p>Partial views: 37 CFR 1.84(h)(2)</p> <p>Brackets needed to show figure as one entity. Fig(s) _____</p> <p>Views not labeled separately or properly. Fig(s) _____</p> <p>Enlarged view not labeled separately or properly. Fig(s) _____</p> <p>7. SECTIONAL VIEWS: 37 CFR 1.84 (h)(3)</p> <p>Hatching not indicated for sectional portions of an object. Fig(s) _____</p> <p>Sectional designation should be noted with Arabic or Roman numbers. Fig(s) _____</p>	<p>ARRANGEMENT OF VIEWS: 37 CFR 1.84(f)</p> <p>Views do not appear on a horizontal left-to-right fashion and when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s) _____</p> <p>SCALE: 37 CFR 1.84(g)</p> <p>Scale not large enough to show mechanism without crowding when drawing is reduced in size to two-thirds in reproduction. Fig(s) _____</p> <p>10. CHARACTER OF LINES, NUMBERS, & LETTERS: 37 CFR 1.84(f)</p> <p>Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (poor line quality). Fig(s) <u>1, 8</u></p> <p>SHADING: 37 CFR 1.84(m)</p> <p>Solid black areas pale. Fig(s) _____</p> <p>Solid black shading not permitted. Fig(s) _____</p> <p>Shade lines, pale, rough and blurred. Fig(s) <u>12</u></p> <p>12. NUMBERS, LETTERS, & REFERENCE CHARACTERS: 37 CFR 1.84(p)</p> <p>Numbers and reference characters not plain and legible. Fig(s) <u>1, 8</u></p> <p>Figure legends are poor. Fig(s) <u>1-8</u></p> <p>Numbers and reference characters not oriented in the same direction as the view. 37 CFR 1.84(p)(3) Fig(s) _____</p> <p>English alphabet not used. 37 CFR 1.84(p)(2) Fig(s) _____</p> <p>Numbers, letters and reference characters must be at least .32 cm (1/8 inch) in height. 37 CFR 1.84(p)(3) Fig(s) _____</p> <p>13. LEAD LINES: 37 CFR 1.84(q)</p> <p>Lead lines cross each other. Fig(s) _____</p> <p>Lead lines missing. Fig(s) _____</p> <p>14. NUMBERING OF SHEETS OF DRAWINGS: 37 CFR 1.84(t)</p> <p>Sheets not numbered consecutively, and in Arabic numerals beginning with number 1. Sheet(s) _____</p> <p>15. NUMBERING OF VIEWS: 37 CFR 1.84(u)</p> <p>Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s) _____</p> <p>16. CORRECTIONS: 37 CFR 1.84(w)</p> <p>Corrections not made from prior PTO-948 dated _____</p> <p>17. DESIGN DRAWINGS: 37 CFR 1.152</p> <p>Surface shading shown not appropriate. Fig(s) _____</p> <p>Solid black shading not used for color contrast. Fig(s) _____</p>
<p>COMMENTS</p>	

REVIEWER CHASE

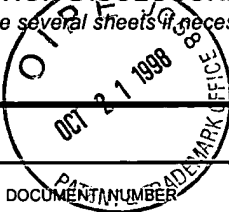
DATE 6-17-99

TELEPHONE NO. 703 305 8430

ATTACHMENT TO PAPER NO. 5

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)



ATTY DOCKET NO.

29214

SERIAL NO.

09/113,254

APPLICANT (S)

Daniel Paul Madigan et al

FILING DATE

07/10/98

GROUP

Unassigned- 1649

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
Amc	56,140	07/1866	Blessing	—	—	
Amc	2,664,350	12/1953	Hale et al	71	1	
Amc	3,545,129	12/1970	Schreiber et al	47	57.6	
Amc	3,621,612	11/1971	Porter	47	58	
Amc	3,698,133	10/1972	Schreiber	47	57.6	
Amc	3,936,976	02/1976	Porter et al	47	57.6	
Amc	3,947,996	04/1976	Watts	47	57.6	
Amc	3,950,891	04/1976	Hinkes	47	57.6	
Amc	4,116,666	09/1978	Willard, Sr.	71	77	
Amc	4,192,095	03/1980	Haslam et al	47	58	
Amc	4,272,417	06/1981	Barke et al	260	22 R	

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO
Amc	2354101	05/1974	Germany	A 01 c	07/00		✓

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

Amc		Pietsch, Wolfgang, "Part 2. Agglomerate Bonding and Strength," Date unknown. (Reprinted from W. Pietsch (98)).
Amc		Staub-Reinhalt, Luft, "Part 3, THE AGGLOMERATIVE BEHAVIOR OF FINE PARTICLES," (Reprinted from W. Pietsch (7), English edition). Vol. 27, No. 1, January 1967.

EXAMINER

Anne Marie Gumberg

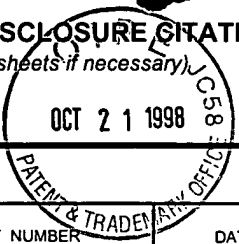
DATE CONSIDERED

13 June 99

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)



ATTY DOCKET NO.

29214

SERIAL NO.

09/113,254

APPLICANT (S)

Daniel Paul Madigan et al

FILING DATE

07/10/98

GROUP

Unassigned 1649

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AMG	4,344,979	08/1982	Gago et al	427	4	
AMG	4,438,593	03/1984	McNew et al	47	57.6	
AMG	4,452,008	06/1984	Sandhu et al	47	57.6	
AMG	4,493,162	01/1985	Langan et al	47	57.6	
AMG	4,752,319	06/1988	DelliColli	71	77	
AMG	4,759,151	07/1988	Gerber	47	57.6	
AMG	5,044,116	09/1991	Gago et al	47	57.6	
AMG	5,087,475	02/1992	Bazin et al	427	4	
AMG	5,106,648	04/1992	Williams	427	3	
AMG	5,127,185	07/1992	Kojimoto et al	47	57.6	
AMG	5,300,127	04/1994	Williams	47	57.6	

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
						YES	NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER

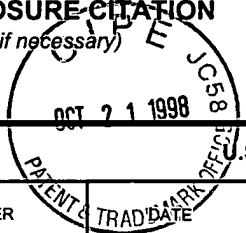
Anne Marie Gruber

DATE CONSIDERED

13 June 1999

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

INFORMATION DISCLOSURE CITATION
(Use several sheets if necessary)



ATTY DOCKET NO.
29214

SERIAL NO.
09/113,254

APPLICANT(S)
Daniel Paul Madigan et al

FILING DATE
07/10/98

GROUP
Unassigned Key 9

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AMB	5,368,626	11/1994	Schnuda	71	23	
AMB	5,525,131	06/1996	Asano	47	57.6	
AMB	5,623,781	04/1997	Legro	47	576	

FOREIGN PATENT DOCUMENTS

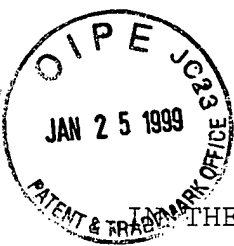
DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
					YES	NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER *Anne Marie Gruber*

DATE CONSIDERED *13 June 1999*

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.



Receipt #4
29214

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:
Daniel Paul Madigan et al

Group Art Unit: 3616

Serial Number: 09/113,254

Examiner: Unknown

Filed: 07/10/98

For: SEEDING TREATMENTS

REQUEST FOR CORRECTION TO FILING RECEIPT

Application Processing Division
Customer Correction Branch
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Applicants note that the subject application has an incorrect city name for RONALD DEAN EICHHORN on the Filing Receipt (PTO-103X).

The correct city for RONALD D. EICHHORN should be "GREEN BAY".

Applicants respectfully request that the city of the inventor be corrected. These corrections have been noted on the copy of the **Filing Receipt** enclosed herewith. A copy of the title page as originally submitted is also enclosed.

Respectfully submitted,
Daniel Paul Madigan et al

By: Thomas D. Wilhelm
Thomas D. Wilhelm
Attorney for Applicants
(Reg. No. 28,794)

January 22, 1999
Appleton, Wisconsin 54911
(920) 831-0100
(920) 831-0101 FAX

RECEIVED

FEB 08 1999

MATRIX CUSTOMER SERVICE CENTER

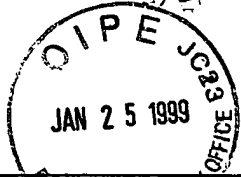
I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO APPLICATION PROCESSING DIVISION, CUSTOMER CORRECTION BRANCH, ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231

ON January 22, 1999.

Kerri Bruchs
(Typed name of person mailing paper or fee)
Kerri Bruchs
(Signature) 1/22/99
(Date Of Signature)

RECEIVED JAN 1 1999

FILING RECEIPT
CORRECTED



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTORNEY DOCKET NO.	DRWGS	TOT CL	IND CL
09/113,254	07/10/98	3616	\$1,147.00	29214	6	75	5

THOMAS D WILHELM
WILHELM LAW SERVICE
100 W LAWRENCE STREET
THIRD FLOOR
APPLETON WI 54911

Receipt is acknowledged of this nonprovisional Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Application Processing Division's Customer Correction Branch within 10 days of receipt. Please provide a copy of the Filing Receipt with the changes noted thereon.

Applicant(s)

DANIEL PAUL MADIGAN, GREEN BAY, WI; MICHAEL DENNIS
KRYSIK, GREEN BAY, WI; RONALD DEAN EICHHORN, ~~EICHHORN,~~
WI; GLEN H. WESENBERG, GREEN BAY, WI. GREEN BAY

FOREIGN FILING LICENSE GRANTED 07/28/98
TITLE
SEEDING TREATMENTS

PRELIMINARY CLASS: 047

RECEIVED

FEB 08 1999

MATRIX-CUSTOMER
SERVICE CENTER

**LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15**

GRANTED

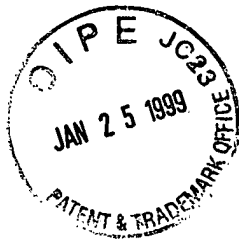
The applicant has been granted a license under 35 U.S.C. 184, if the phrase "FOREIGN FILING LICENSE GRANTED" followed by a date appears on the reverse side of this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.11. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related application(s) filed under 37 CFR 1.62 which meets the provisions of 37 CFR 5.15(a). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations, especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR Parts 121-128)); the Office of Export Administration, Department of Commerce (15 CFR 370.10 (j)); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "FOREIGN FILING LICENSE GRANTED" DOES NOT appear on the reverse side of this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).



RECEIVED

PATENT APPLICATION

FEB 08 1999

TITLE: SEEDING TREATMENTS

MARKET CUSTOMER
SERVICE CENTER

By: Daniel Paul Madigan
804 S. Madison
Green Bay, WI 54301
Citizenship: USA

Michael Dennis Krysiak
3554 Highland Center Drive
Green Bay, WI 54311
Citizenship: USA

Ronald Dean Eichhorn
1524 1/2 Cedar Street
Green Bay, WI 54302
Citizenship: USA

Glen H. Wesenberg
920 Laverne Drive
Green Bay, WI 54311
Citizenship: USA

"Express Mail" mailing number
EM 469 259 847 US

Date of Deposit June 10, 1998

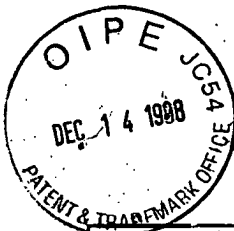
I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner of Patents, Washington, D.C. 20231.

Jerry F. Janssen

(Typed or printed name of person mailing paper or fee)

(Signature of person mailing paper or fee)

TDW, JSK



Sector \$

UNITED STATES DEPARTMENT OF COMMERCE
 Patent and Trademark Office
 Address: COMMISSIONER OF PATENTS AND TRADEMARKS
 Washington, D.C. 20231

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO./TITLE
--------------------	---------------------	-----------------------	---------------------------

097113, 254 07/10/98 MADIGAN D 29214

0232, 0813

THOMAS D. WILHELM
 WILHELM LAW SERVICE
 100 W. LAWRENCE STREET
 THIRD FLOOR
 APPLETON WI 54911

NOT ASSIGNED

3616

DATE MAILED:

08/13/98

NOTICE TO FILE MISSING PARTS OF APPLICATION
Filing Date Granted

An Application Number and Filing Date have been assigned to this application. The items indicated below, however, are missing. Applicant is given TWO MONTHS FROM THE DATE OF THIS NOTICE within which to file all required items and pay fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a). If any of items 1 or 3 through 5 are indicated as missing, the SURCHARGE set forth in 37 CFR 1.16(e) of \$65.00 for a small entity in compliance with 37 CFR 1.27, or \$130.00 for a non-small entity, must also be timely submitted in reply to this NOTICE to avoid abandonment.

If all required items on this form are filed within the period set above, the total amount owed by applicant as a small entity (statement filed) non-small entity is \$ 2274

- 1. The statutory basic filing fee is:
 - missing.
 - insufficient.
 Applicant must submit \$ 790 to complete the basic filing fee and/or file a small entity statement claiming such status (37 CFR 1.27).
- 2. Additional claim fees of \$ 1374, including any multiple dependent claim fees, are required.
 - \$ 164 for 2 independent claims over 2.
 - \$ 1210 for 55 dependent claims over 20.
 - \$ _____ for multiple dependent claim surcharge.
 Applicant must either submit the additional claim fees or cancel additional claims for which fees are due.
- 3. The oath or declaration:
 - is missing or unexecuted.
 - does not cover the newly submitted items.
 - does not identify the application to which it applies.
 - does not include the city and state or foreign country of applicant's residence.
 An oath or declaration in compliance with 37 CFR 1.63, including residence information and identifying the application by the above Application Number and Filing Date is required.
- 4. The signature(s) to the oath or declaration is/are by a person other than inventor or person qualified under 37 CFR 1.42, 1.43 or 1.47.
 A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- 5. The signature of the following joint inventor(s) is missing from the oath or declaration:

 An oath or declaration in compliance with 37 CFR 1.63 listing the names of all inventors and signed by the admitted inventor(s), identifying this application by the above Application Number and Filing Date, is required.
- 6. A \$50.00 processing fee is required since your check was returned without payment (37 CFR 1.223(m)).
- 7. Your filing receipt was mailed in error because your check was returned without payment.
- 8. The application does not comply with the Sequence Rules.
 See attached "Notice to Comply with Sequence Rules 37 CFR 1.821-1.825."
- 9. OTHER:

Direct the reply and any questions about this notice to "Attention: Box Missing Parts."

A copy of this notice MUST be returned with the reply

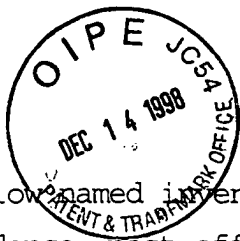
Customer Service Center
 Initial Patent Examination Division (703) 308-1202

P. 137

PART 3 - OFFICE COPY

SteadyMed v. United Therapeutics
 IPR2016-00006

0000010 23230
 09/21/1998 CHRGMS
 65 62 605 256
 139.00 CH



DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled SEEDING TREATMENTS, the specification of which

(check one) is filed herewith.

 X was filed on July 10, 1998

 X Application Serial No. 09/113,254
and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56 (a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

(Number)

(Country)

(Day/Month/Year Filed)

(Yes)

(No)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

60/052,287
(Application Serial No.)

07/11/97
(Filing Date)

Provisional
(Status-Patented, Pending, Abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

THOMAS D. WILHELM (REG. NO. 28794), JERRY F. JANSSEN (REG. NO. 29175), JASBIR S. KINDRA (REG. NO. 41115)

Address all telephone calls to THOMAS D. WILHELM at telephone no. 920-831-0100

Address all correspondence to THOMAS D. WILHELM at the following address:

100 W. LAWRENCE ST. FLOOR 3

APPLETON, WI 54911 USA

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor Daniel Paul Madigan

Inventor's signature Daniel Paul Madigan Date 10/13/98

Residence 804 S. Madison, Green Bay, Wisconsin 54301 Citizen USA

Post Office Address 804 S. Madison, Green Bay, Wisconsin 54301 USA

Full name of second joint inventor, if any Michael Dennis Krysiak

Second Inventor's signature Michael Dennis Krysiak Date 10/19/98

Residence 3554 Highland Center Drive, Green Bay, Wisconsin 54311 Citizen USA

Post Office Address 3554 Highland Center Drive, Green Bay, Wisconsin 54311 USA

Additional inventors are named on sheet 2 Bf138 sheets.

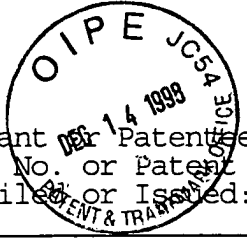
UT Ex. 2025

SteadyMed v. United Therapeutics

IPR2016-00006

Full name of third joint inventor, if any Ronald Dean Eichhorn
Third Inventor's signature *Ronald D. Eichhorn* Date 10/19/98
Residence 1524 1/2 Cedar Street, Green Bay, Wisconsin 54302 Citizen USA
Post Office Address 1524 1/2 Cedar Street, Green Bay, Wisconsin 54302 USA

Full name of fourth joint inventor, if any Glen H. Wesenberg
Inventor's signature *Glen H. Wesenberg* Date 20 Oct. 98
Residence 920 Laverne Drive, Green Bay, Wisconsin 54311 Citizen USA
Post Office Address 920 Laverne Drive, Green Bay, Wisconsin 54311 USA



Applicant Patentee: DANIEL PAUL MADIGAN ET AL Attorney's
 Serial No. or Patent No.: 09/113,254 Docket No. 29214
 Date Filed or Issued: July 10, 1998
 For: SEEDING TREATMENTS

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
 STATUS (37 CFR 1.9(f) AND 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled SEEDING TREATMENTS and described in

- the specification filed herewith
- application serial no. 09/113,254, filed 07/10/98
- patent no. _____, issued _____.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- no such person, concern, or organization
- persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME FEECO International Inc.
 ADDRESS 3913 Algoma Road, Green Bay, Wisconsin 54311
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

FULL NAME _____
 ADDRESS _____
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

FULL NAME _____
 ADDRESS _____
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

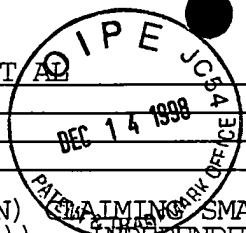
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Daniel Paul Madigan
 TYPED NAME OF INVENTOR
Daniel Paul Madigan
 Signature of Inventor
10/13/98
 Date

Michael Dennis Krysiak
 TYPED NAME OF INVENTOR
Michael Dennis Krysiak
 Signature of Inventor
10-15-98
 Date

Ronald Dean Eichhorn
 TYPED NAME OF INVENTOR
Ronald Dean Eichhorn
 Signature of Inventor
10-19-98
 Date

Applicant or Patentee: DANIEL PAUL MADIGAN ET AL Attorney's
Serial No. or Patent No.: 09/113,254 Docket No. 29214
Date Filed or Issued: July 10, 1998
For: SEEDING TREATMENTS



VERIFIED STATEMENT (DECLARATION)
STATUS (37 CFR 1.9(f) AND 1.27(b)) - SMALL ENTITY INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled SEEDING TREATMENTS and described in

- the specification filed herewith
- application serial no. 09/113,254, filed 07/10/98
- patent no. _____, issued _____.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- no such person, concern, or organization
- persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME FEECO International Inc.
ADDRESS 3913 Algoma Road, Green Bay, Wisconsin 54311
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

FULL NAME _____
ADDRESS _____
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

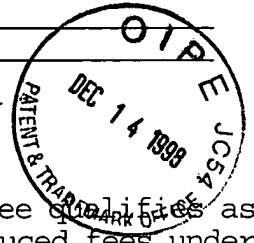
FULL NAME _____
ADDRESS _____
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

<u>Glen H. Wesenberg</u> TYPED NAME OF INVENTOR	_____	_____
<u><i>Glen H. Wesenberg</i></u> Signature of Inventor	_____	_____
<u>20 Oct. 98</u> Date	_____	_____

Applicant or Patentee: DONIE PAUL MADIGAN ET AL Attorneys
Serial or Patent No.: 09/113,254 Docket No. 29214
Date Filed or Issued: July 10, 1998
For: SEEDING TREATMENTS



VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) AND 1.27(b)) - SMALL ENTITY

As a representative of the assignee, I hereby declare that the assignee qualifies as a small entity as defined in 37 CFR 1.9(d) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35 United States Code, to the Patent and Trademark Office with regard to the invention entitled SEEDING TREATMENTS and described in

- the Provisional Patent Application filed herewith
- application serial no. 09/113,254, filed 07/10/98
- patent no. _____, issued _____.

The assignee has not signed, granted, conveyed, or licensed and is under no obligation under contract of law to assign, grant, convey, or license any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which the assignee has assigned, granted, conveyed, or licensed or is under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- no such person, concern, or organization
- person, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME _____
ADDRESS _____
 INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

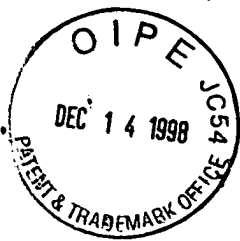
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Dan Madigan, President
TYPED NAME OF PERSON SIGNING TITLE

FEECO International Green Bay, Wisconsin
IDENTITY OF ASSIGNEE BEING REPRESENTED ASSIGNEE'S CITY AND STATE

Don Madigan
SIGNATURE

10/13/98
DATE SIGNED



29214
Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:
Daniel Paul Madigan et al

Group Art Unit: 3616

Serial Number: 09/113,254

Examiner: Unassigned

Filed: 07/10/98

For: SEEDING TREATMENTS

RESPONSE TO NOTICE TO FILE MISSING PARTS

Attention: Box Missing Parts
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This paper is submitted in response to the Notice To File Missing Parts dated 08/13/98 in the above-identified application. The Missing Parts required are the Surcharge and Filing Fees.

Applicants enclose herewith the following documents:

- Petition For Extension of Time - two months;
- copy of Notice to File Missing Parts of Application;
- Declaration, signed 10/13/98, 10/19/98 and 10/20/98 (2 sheets);
- Inventors' Small Entity Statement, signed 10/13/98, 10/15/98, 10/19/98, and 10/20/98 respectively (2 sheets);
- Assignee Small Entity Statement, signed 10/13/98 (1 sheet);
- Check #5283 for \$65.00, for the Missing Parts Fee;
- Check #5284 for \$953.00, for the Filing Fee; and
- Check #5285 for \$190.00, for the Petition for Extension Fee

I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO BOX MISSING PARTS, ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231

ON December 11, 1998.

Kerri Bruchs
(Typed name of person mailing paper or fee)

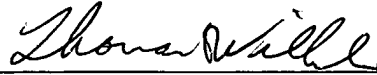
Kerri Bruchs
(SIGNATURE)

12/11/98
(DATE OF SIGNATURE)

Applicants submit that all parts of the application are now present in the PTO, and request that the Official Receipt be issued forthwith.

Should any additional fee be properly due, kindly charge same to Deposit Account 23-2130.

Respectfully submitted,
Daniel Paul Madigan et al

By: 
Thomas D. Wilhelm,
Attorney for Applicants
(Reg. No. 28,794)

December 9, 1998
Appleton, Wisconsin
920-831-0100
920-831-0101 FAX

**PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)
(Small Entity)**

Docket No.
29214

In Re Application Of: Daniel Paul Madigan et al

Serial No.
09/113,254

Filing Date
07/10/98

Examiner
Unassigned

Group Art Unit
3616

Invention: SEEDING TREATMENTS



TO THE ASSISTANT COMMISSIONER FOR PATENTS:

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response to the Office Action of 08/13/98 in the above-identified application.
Date

The requested extension is as follows (check time period desired):

- One month Two months Three months Four months Five months

from: 10/13/98 until: 12/13/98
Date *Date*

A verified statement of small entity status as a small entity under 37 CFR 1.27:

- is enclosed.
 has already been filed in this application.

The fee for the extension of time is \$190 and is to be paid as follows:

- A check in the amount of the fee is enclosed.
 The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. 23-2130
A duplicate copy of this sheet is enclosed.
 If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No. 23-2130 A duplicate copy of this sheet is enclosed.

Thomas D. Wilhelm
Signature

Dated: December 11, 1998

Thomas D. Wilhelm (Reg. No. 28,794)
Wilhelm Law Service
100 W. Lawrence St., Third Floor
Appleton, WI 54911

I certify that this document and fee is being deposited on December 11, 1998 with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Kerri Bruchs

Signature of Person Mailing Correspondence

Kerri Bruchs

Typed or Printed Name of Person Mailing Correspondence

UT Ex. 2025

12/21/1998 CHRG 00000010 232130 09113254
01 FC:216 200.00 OP

CC:



0300

29214
Patent

#3/4R.
01/22/99

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:
Daniel Paul Madigan et al

Group Art Unit: Unassigned

Serial Number: 09/113,254

Examiner: Unassigned

Filed: 07/10/98

For: SEEDING TREATMENTS

INFORMATION DISCLOSURE STATEMENT

Hon. Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Pursuant to Applicants' duty of disclosure set forth in 37 C.F.R. § 1.56, the Applicants wish to bring to the Examiner's attention the references listed here and on the attached PTO Form 1449.

No representation is made, and no representation is intended, that more relevant material does not exist or that the order of presentation of these materials in any way reflects their relative pertinence. The references cited on the attached PTO Form 1449 are not intended to constitute an admission of any kind. Specifically, this presentation is not an admission that any of the items listed on the attached PTO Form 1449 are properly citable against the above-identified application.

In accordance with the provisions of 37 C.F.R. § 1.98, the references are listed on the attached PTO Form 1449 and copies

I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231

ON October 19, 1998.

Kerri Bruchs
(TYPED NAME OF PERSON MAILING PAPER OR FEE)

Kerri Bruchs
(SIGNATURE)

October 19, 1998
(DATE OF SIGNATURE)

are submitted herewith. The attached copies have been pulled from the Applicants' or assignee's file. Accordingly, some of the references may have written indicia thereon. It is requested that the Examiner ignore all such written indicia as such indicia may not be relevant to the instant case or may not be an accurate characterization of the reference.

This Information Disclosure Statement is being filed before issuance of a first Office Action or within three months of the filing date of the referenced patent application. Accordingly, no fee is due. Nevertheless, the Commissioner is hereby authorized to charge payment of any additional fees due under 37 C.F.R. § 1.17 or credit any overpayment to Deposit Account No. 23-2130. It is Applicants' desire to have these references available in the record for both the Examiner and the public to review. Applicants, therefore, request that the Examiner review the entire disclosure of each reference and make all references of record.

U.S. Patent Documents

56,140	Blessing
2,664,350	Hale et al
3,545,129	Schreiber et al
3,621,612	Porter
3,698,133	Schreiber
3,936,976	Porter et al
3,947,996	Watts
3,950,891	Hinkes
4,116,666	Willard, Sr.
4,192,095	Haslam et al
4,272,417	Barke et al
4,344,979	Gago et al
4,438,593	McNew et al
4,452,008	Sandhu et al
4,493,162	Langan et al
4,752,319	DelliColli
4,759,151	Gerber
5,044,116	Gago et al
5,087,475	Bazin et al
5,106,648	Williams
5,127,185	Kojimoto et al
5,300,127	Williams
5,368,626	Schnuda

5,525,131 Asano
5,623,781 Legro

Foreign Patent Document

2354101 Germany

Other Documents

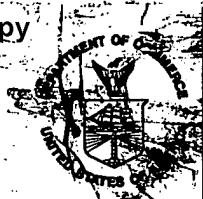
Pietsch, Wolfgang, "Part 2. Agglomerate Bonding and Strength," Date unknown. (Reprinted from W. Pietsch (98)).

Staub-Reinhalt, Luft, "Part 3, THE AGGLOMERATIVE BEHAVIOR OF FINE PARTICLES," (Reprinted from W. Pietsch (7), English edition). Vol. 27, No. 1, January 1967.

Respectfully submitted,
Daniel Paul Madigan et al

By: Thomas D. Wilhelm
Thomas D. Wilhelm,
Attorney for Applicants
(Reg. No. 28,794)

October 19, 1998
Appleton, Wisconsin
920-831-0100
920-831-0101 FAX



APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO./TITLE
097413,254	07/10/98	MADIGAN	D 29214

0232/0813

THOMAS D WILHELM
WILHELM LAW SERVICE
2100 W. LAWRENCE STREET
THIRD FLOOR
APPLETON WI 54911

NOT ASSIGNED

3616

DATE MAILED:

08/13/98

NOTICE TO FILE MISSING PARTS OF APPLICATION
Filing Date Granted

An Application Number and Filing Date have been assigned to this application. The items indicated below, however, are missing. Applicant is given **TWO MONTHS FROM THE DATE OF THIS NOTICE** within which to file all required items and pay fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a). If any of items 1 or 3 through 5 are indicated as missing, the **SURCHARGE** set forth in 37 CFR 1.16(e) of \$65.00 for a small entity in compliance with 37 CFR 1.27, or \$130.00 for a non-small entity, must also be timely submitted in reply to this NOTICE to avoid abandonment.

If all required items on this form are filed within the period set above, the total amount owed by applicant as a small entity (statement filed) non-small entity is \$ 822.00

1. The statutory basic filing fee is:

- missing.
- insufficient.

Applicant must submit \$ 790 to complete the basic filing fee and/or file a small entity statement claiming such status (37 CFR 1.27).

2. Additional claim fees of \$ 1374 including any multiple dependent claim fees, are required.

\$ 169 for 2 independent claims over 3

\$ 120 for 5 dependent claims over 20.

\$ _____ for multiple dependent claim surcharge.

Applicant must either submit the additional claim fees or cancel additional claims for which fees are due.

3. The oath or declaration:

- is missing or unexecuted.
- does not cover the newly submitted items.
- does not identify the application to which it applies.
- does not include the city and state or foreign country of applicant's residence.

An oath or declaration in compliance with 37 CFR 1.63, including residence information and identifying the application by the above Application Number and Filing Date is required.

4. The signature(s) to the oath or declaration is/are by a person other than inventor or person qualified under 37 CFR 1.42, 1.43 or 1.47.

A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

5. The signature of the following joint inventor(s) is missing from the oath or declaration:

An oath or declaration in compliance with 37 CFR 1.63 listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Filing Date is required.

6. A processing fee is required since your check was returned without payment (37 CFR 1.41(m)).

7. A filing receipt was mailed in error because your check was returned without payment.

8. The application does not comply with the Sequence Rules.

See attached Notice to Comply with Sequence Rules 37 CFR 1.821-1.825.

9. OTHER

Direct the reply and any questions about this notice to "Attention: Box Missing Parts."

A copy of this notice MUST be returned with the reply.

A

06/10/98

6505 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL (Small Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
29214

Total Pages in this Submission
82

TO THE ASSISTANT COMMISSIONER FOR PATENTS

Box Patent Application
Washington, D.C. 20231

6551 U.S. PTO
09/11/254
07/10/98

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

SEEDING TREATMENTS

and invented by:

DANIEL PAUL MADIGAN
MICHAEL DENNIS KRYSIAK
RONALD DEAN EICHHORN
GLEN H. WESENBERG

If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:

Continuation Divisional Continuation-in-part (CIP) of prior application No.: _____

Which is a:

Continuation Divisional Continuation-in-part (CIP) of prior application No.: _____

Which is a:

Continuation Divisional Continuation-in-part (CIP) of prior application No.: _____

Enclosed are:

Application Elements

1. Filing fee as calculated and transmitted as described below
2. Specification having 70 pages and including the following:
 - a. Descriptive Title of the Invention
 - b. Cross References to Related Applications (if applicable)
 - c. Statement Regarding Federally-sponsored Research/Development (if applicable)
 - d. Reference to Microfiche Appendix (if applicable)
 - e. Background of the Invention
 - f. Brief Summary of the Invention
 - g. Brief Description of the Drawings (if drawings filed)
 - h. Detailed Description
 - i. Claim(s) as Classified Below
 - j. Abstract of the Disclosure

**UTILITY PATENT APPLICATION TRANSMITTAL
(Small Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
29214

Total Pages in this Submission
82

Application Elements (Continued)

3. Drawing(s) *(when necessary as prescribed by 35 USC 113)*
a. Formal b. Informal Number of Sheets 6
4. Oath or Declaration
a. Newly executed *(original or copy)* Unexecuted
b. Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
c. With Power of Attorney Without Power of Attorney
d. DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application,
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied
under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby
incorporated by reference therein.
6. Computer Program in Microfiche
7. Genetic Sequence Submission *(if applicable, all must be included)*
a. Paper Copy
b. Computer Readable Copy
c. Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. Assignment Papers *(cover sheet & documents)*
9. 37 CFR 3.73(b) Statement *(when there is an assignee)*
10. English Translation Document *(if applicable)*
11. Information Disclosure Statement/PTO-1449 Copies of IDS Citations
12. Preliminary Amendment
13. Acknowledgment postcard
14. Certificate of Mailing
 First Class Express Mail *(Specify Label No.):* EM 469 259 847 US

**UTILITY PATENT APPLICATION TRANSMITTAL
(Small Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
29214

Total Pages in this Submission
82

Accompanying Application Parts (Continued)

15. Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. Small Entity Statement(s) - Specify Number of Statements Submitted: _____
17. Additional Enclosures *(please identify below):*

Correspondence Address

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	75	- 20 =	55	x \$11.00	\$605.00
Indep. Claims	5	- 3 =	2	x \$41.00	\$82.00
Multiple Dependent Claims (check if applicable)		<input type="checkbox"/>			\$0.00
BASIC FEE					\$395.00
OTHER FEE (specify purpose) _____					\$0.00
TOTAL FILING FEE					\$1,082.00

- A check in the amount of _____ to cover the filing fee is enclosed.
- The Commissioner is hereby authorized to charge and credit Deposit Account No. _____ as described below. A duplicate copy of this sheet is enclosed.
- Charge the amount of _____ as filing fee.
 - Credit any overpayment.
 - Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
 - Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated: *July 10, 1998*

Thomas D. Wilhelm
Signature

Thomas D. Wilhelm (Reg. No. 28,794)

cc:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:
Daniel Paul Madigan et al

Group Art Unit: Unassigned

Serial Number: Unassigned

Examiner: Unassigned

Filed: July 10, 1998

For: SEEDING TREATMENTS

CORRESPONDENCE ADDRESS

Hon. Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Kindly address all correspondence regarding the above-referenced Application to the following address:

Thomas D. Wilhelm
Wilhelm Law Service, S.C.
100 W. Lawrence Street
Third Floor
Appleton, WI 54911

Phone 920-831-0100
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Respectfully submitted,
Daniel Paul Madigan et al

By Thomas D. Wilhelm
Thomas D. Wilhelm
Attorney for Applicants
(Reg. No. 28,794)

July 10, 1998
Appleton, Wisconsin

PATENT APPLICATION

TITLE: SEEDING TREATMENTS

By: Daniel Paul Madigan
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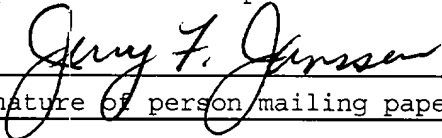
"Express Mail" mailing number
EM 469 259 847 US

Date of Deposit June 10, 1998

2025 RELEASE UNDER E.O. 14176

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner of Patents, Washington, D.C. 20231.

Jerry F. Janssen
(Typed or printed name of person mailing paper or fee)


(Signature of person mailing paper or fee)

TDW, JSK

SEEDING TREATMENTSField of the Invention

5 This present invention relates to improvements in seed and
seed-related products, processes for making such products and
processes for establishing and improving seed beds and seed bed
germination. As additional benefits, this invention is directed at
improving soil productivity through enhancements in soil fertility,
soil condition/tilth, and control of soil moisture. Further, the
10 invention relates to productive use of certain types of abundantly
available manufacturing waste, which waste is currently being
disposed of in landfills.

Background of the Invention

15 Agricultural growers, gardeners, landscape operators, flower
growers, and the like produce a wide variety of cultivated crops.
Many such crops are grown from seed. The sizes, shapes, and
physical characteristics of the various kinds of seeds are as
varied as the number of crops produced therefrom.
20

Producers of such cultivated crops encounter a variety of
challenges in handling and distributing such seed, as well as with
sowing of such seed in suitable growing media. Certain seed may
desirably be sowed by a broadcast method if the seed were
25 compatible with broadcast application. For example, grass seed for
lawns is desirably broadcast, but the low density and generally
non-aerodynamic shape of some grass seed can limit the range of
such broadcast, and make such seed susceptible to being blown about

by wind, or washed away by surface water, even if initially well placed in a good seeding application.

Another difficulty encountered in sowing seed is that the seed may be so small as to be difficult to handle, thereby to place properly-spaced seeds at a desired spacing as to make cost-effective use of the seed, thereby to produce a crop of the related plants without using any more seed than necessary, thus to gain maximum benefit from the amount of seed used.

While small seed may be efficiently handled by industrial equipment especially designed for handling such seed, typically the user of such seed also handles various other types of seed; and may be unable to justify the cost of such specialty seed-handling equipment. Rather, the seed user typically has a limited range of seed handling equipment which must be capable of being used and/or adapted to handle and apply all the types of seeds being used by that user. Where the seed itself can be adapted to the equipment, specialty seed can be handled without need for any specialized equipment.

Even where the seed may be sown by hand, such as in seedling or bedding trays or pots, some seeds are so small as to be difficult for the sower/user to effectively manipulate and control by hand. Typical of such difficult-to-handle seeds are seeds of lettuce, carrots, the cabbage family, ground cherries, and alfalfa. Many flower seeds are equally small and/or difficult to handle and/or manipulate, for example poppy seed.

When seed is planted, the seed has immediate use for moisture to aid in germination of the seed, and subsequent early development of the resulting young plant. Where moisture is not readily available to the seed when planted, the seed may lie in a dormant state for some period of time before germinating. While the seed is thus dormant, awaiting suitable moisture, the seed is subject to a variety of hazards which may destroy its viability. The seed may be attacked by worms, parasites, and other pests. The seed may be

eaten by foraging animals including insects and larvae. The seed may be overheated by a hot sun. The seed may lie dormant without germinating for so long that any plant emerging therefrom will have insufficient time to mature before the end of the growing season.

5 If and when the seed does germinate, the seedling plant has a continuing need for a proper balance of moisture and oxygen, as well as for such plant nutrients as nitrogen, phosphorous, and potash, as well as the micronutrients, in relatively predictable quantities. To the extent the proper balance of such materials is available to the young plant, a healthy young plant may be produced, with optimum potential for maximum crop production, assuming germination occurs at a seasonably-desirable time.

10 To the extent one or more such materials is not available to the seed and/or the young plant, plant growth, plant health, and ultimately maturity, may be adversely affected. For example, the soil may be too dry to support germination, or optimum germination. Or while the soil may in general have a desired moisture content, moisture content at a macro level can vary widely. Thus, while the soil in general may have a desirable moisture content, the microcosm of the soil adjacent an individual seed may be too dry, or too wet, to support any germination, or optimum germination.

15 Similarly, the soil may be generally depleted of one or more plant nutrients needed by the germinated seedling. Or while the soil may in general have desired nutrient levels, the nutrient levels at a macro level can vary widely. Thus, the microcosm of the soil adjacent an individual seed may be too low in one or more nutrients to support a desired level of plant growth, or so high as to be toxic to a desired level of plant growth.

20 Further, plant nutrient chemicals may be present in the soil, but so tied up chemically in the soil as to be unavailable, or poorly available, relative to the quantities and use rates needed for desired plant growth. Or the soil may become so hard, dry, and/or caked shortly after the seed germinates that the seedling

plant has difficulty penetrating such soil, difficulty becoming associated suitable nutrients, and/or difficulty taking up such nutrients because of insufficient moisture availability.

5 After the plant has further developed such that the plant roots extend deeper into the soil, conditions of the soil near the surface are less critical. However, until such time as the roots so penetrate, conditions of the soil at and near the top surface of the soil may be critical.

10 Soil fertility generally relates to uptake of plant nutrients from the soil by plants. Uptake is generally the result of two factors, the presence of plant nutrients in the soil, and the availability of the plant nutrients for plant uptake. Presence of plant nutrients in the soil is generally a function of the combination of (a) the basic level of soil fertility, (b) depletion by previous crop production and (c) replenishment with fertilizer. Availability of a plant nutrient physically present in the soil for plant uptake is in general related to solubility of the respective nutrient or nutrient combination in a solvent for the nutrient, which solvent is present in the soil, such solvent as water, along with any other material affecting solvation of the plant nutrient into the water or other solvent.

15 20 Plant nutrients are routinely depleted from the soil by crop production, and are routinely added back, or otherwise replenished, to the soil by conventional inorganic fertilizers.

25 In order for plant nutrients in the soil to be available for uptake by plants, the nutrients must be held in the soil without excessive leaching, but must not be held so tightly that the nutrients cannot be released for plant uptake. Thus, nutrient availability requires a balance between holding tightly enough to retain the nutrient in the root zone, without leaching, but not so tight as to make the nutrient unavailable for plant uptake. Thus, 30 the general "condition" or "tilth" of the soil is instrumental in

determining the efficiency with which plant nutrients are utilized for plant nutrition.

A properly conditioned soil has advantageous soil chemistry in combination with advantageous soil texture. Thus, in addition to providing specific plant nutrients, soil users also use products that modify basic soil chemistry, and soil texture.

Basic soil chemistry is modified by adding to the soil, for example, calcium products to provide pH control, and flyash or like products to provide pH control as well as micronutrients.

Soil texture is generally modified by adding to the soil organic matter such as manures, sludges, wood and other plant products and by-products, and the like. While such materials have good soil conditioning properties, plant nutrient value of such materials is fixed and is generally so low that other "fertilizer"-type products must in general be used in addition to the organic matter in order to preserve plant nutrient values in the soil.

The primary object of this invention is to provide solid plant seed capsule products that supply both soil conditioning properties and the seed, which can benefit from such conditioned soil, in a given seed capsule particle.

It is a further object to provide a plant nutrient material, in the seed capsule particle, in amount beneficial to the seedling emerging from the seed, and higher than a naturally-occurring amount of such nutrient in such soil conditioning material, so as to have enhanced chemical nutrient qualities over use of the soil conditioning material alone.

In another aspect, a further object is to provide soil conditioning and optionally nutrient qualities to seed products that reach the soil as the result of fulfilling objectives separate from providing soil fertility or soil conditioning.

Still another object is to provide seed capsules containing fertility-enhancing elements having a high level of plant food

nutrients in combination with a high level of soil conditioning properties.

5 Still another object is to encapsulate a seed in a soil conditioning material using materials rich in plant nutrients as part of the encapsulating agent.

Yet another object is to provide a seed product which reduces the tendency for light weight seeds to be washed away by surface water runoff.

10 Still another object is to provide a seed product which obviates the typical practice of adding straw as a mulch over e.g. grass seed, to protect the seed from being washed away by surface water, from heat of the sun, and to hold moisture in the soil.

15 A further object is to provide products wherein a single seed capsule product particle provides enhanced soil texture and enhanced soil nutrient value at nutrient levels traditionally needed by newly-germinated seedlings, optionally with higher levels of plant nutrient suitably spaced from the seed itself so as to not be toxic to seedling growth, optionally in combination with time-release technology.

20 Yet another object is to provide fertility-enhancing seed capsule products having a suitable level of plant food nutrients in combination with a high level of organic matter as soil conditioning material.

Summary of the Invention

5 The invention generally addresses a combination seed capsule, comprising at least one viable seed, having an outer surface and acting as a core or pseudo-core of said combination seed capsule; and a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed.

10 In general, the coating provides at least one of (i) enhancing broadcast flight properties of the combination seed capsule; (ii) reducing susceptibility to deleterious affects of weather on the combination seed capsule; (ii) enhancing resistance of the combination seed capsule to attack by animals, weeds, or spore-formers; (iv) staged germination of ones of the seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in the seeds; (v) enhancing control of moisture about the seed thereby to assist in seed germination; (vi) release of plant nutrients into soil onto which the combination seed capsule is placed; (vii) soil conditioning effect to soil onto which the combination seed capsule is placed; (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released; (ix) higher embryo emergence and survival rate in a population of the seed capsules, thereby reducing required seed planting density for a desired plant population density; and (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

25 While a wide variety of seeds may be used, in general such seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

30 Preferably, the coating comprises the soil conditioning material in combination with at least one ingredient effective to

reduce susceptibility of the seed capsule to deleterious affect of at least one of animals, weeds, and spore-formers. In some embodiments, the ingredient for reducing such susceptibility of the seed capsule is selected from the group consisting of herbicides, fungicides, for example metalaxyl, and a bitter substance.

In some embodiments, the combination seed capsule further comprises a second coating, separate from the first coating, and comprising at least one ingredient effective to reduce susceptibility of the seed capsule to deleterious effect of at least one of animals, weeds, and spore-formers.

Some embodiments are effective to provide a plant nutrient at a desirable controlled distance from a plant seedling emerging from the seed, in an amount beneficial to the plant seedling.

In other embodiments, the second coating material is intermingled with the first coating material in an outer portion of the first coating, and generally displaced from the seed.

The second coating material can comprise a plant nutrient, beneficial in location and in amount of availability, to a plant seedling emerging from the seed. The second coating composition can comprise an inorganic form of a plant nutrient and can be selected from the group consisting of nitrogen, phosphorus, and potassium. The second coating composition can comprise an inorganic form of a plant nutrient and can be selected from the group consisting of e.g. urea, monammonium phosphate, diammonium phosphate, superphosphate, triple superphosphate, dicalcium phosphate, and potash or a micronutrient such as sulfur, manganese, copper, boron, iron, magnesium, or chromium.

A population of the seed capsules can comprise coatings having a range of properties affecting germination rate of the seeds, thereby to stage germination of the seeds in the population over a period of time longer than the range of germination times inherent in uncoated ones of the seeds. Such properties can be, for

example, a range of hardnesses, or a range of thicknesses, of the coatings.

The coating can comprise a first layer of the soil conditioning material, and a second layer comprising an inorganic, and/or organic, fertilizer, and/or at least one micronutrient, such as, for example, sulfur, manganese, copper, boron, iron, magnesium, or chromium.

A preferred soil conditioning material is a sludge composition, such as a fiber-containing by-product of a paper making operation, or sewage sludge.

The seed capsule can comprise a water-leachable plant nutrient, and/or a leach-retardant composition, such as wax, effective to retard leaching of the leachable plant nutrient out of the combination seed capsule.

In some embodiments, in a population of the combination seed capsules, the coatings in ones, but less than all, of the population, comprise ingredients effective to retard effective penetration of a seed-germinating environment to the seed for germination thereof.

In embodiments preferred for some applications, the seed capsule comprises an inner layer on the outer surface of the seed, and an outer layer, the inner layer enhancing properties of the seed for acting as nucleus in an agglomeration operation agglomerating the coating onto the inner layer.

In some embodiments, the coating comprises an admixture of the soil conditioner and a plant nutrient.

In preferred embodiments, the coating remains generally disposed about the seed, and preferably but not necessarily remains generally intact about the seed, until the seed germinates.

The invention further comprises a plant growing medium extending over an area, the plant growing medium having a root zone, and a top surface of the root zone generally corresponding with a top surface of the plant growing medium, the plant growing

5 medium having a first overall soil condition and texture; and a population of seed capsules disposed over the top surface of the plant growing medium, the seed capsules comprising individual seeds, having outer surfaces, and coatings of soil conditioning material disposed outwardly of the outer surfaces of the seeds, the coatings of the seed capsules providing localized germination and growth environments, at and adjacent the seeds, having texture, and nutrient and water holding properties for supporting seedling health, superior to respective properties as provided overall in
10 the root zone of the plant growing medium.

The invention yet further comprises a method of providing plant micronutrients to soil, the method comprising placing onto the soil a population of combination seed capsules, each comprising at least one seed, and a coating comprising a plant micronutrient material.
15

The coating can comprise a first coating comprising the plant micronutrient, and a second coating, separate and distinct from the first coating, and comprising a soil conditioning material.

The invention yet further comprehends a method of providing a seed bed having enhanced growing conditions for growing seed, the method comprising coating a population of the seeds with a coating material, and thereby providing coatings thereon of such material, the material tending to stabilize, in the seed capsules, or in soil on which the seed capsules are disposed coating compositions which
20 tend to hold, moisture adjacent the seeds in the seed capsules or in soil adjacent the seed capsules, in such quantities and for such times as to enhance growing conditions for the seeds; and placing the population of seeds on soil effective to support germination of the seeds which are in the seed capsules.
25

In some embodiments, the seed capsules comprise inner layers on the outer surfaces of the seeds, and outer layers, the inner layers enhancing properties of the seeds for acting as nuclei in
30

agglomeration operations agglomerating the coatings onto the inner layers.

5 The invention yet further comprehends a method of making a population of combination seed capsules, each comprising a seed, and a coating of a soil conditioning material, the method comprising pre-coating the seed with a material which enhances the ability of the seed to act as a nucleus in an agglomeration operation, to form a pre-coated substrate; and subsequently coating the pre-coated substrate with a soil conditioning material.
10 A preferred pre-coating material comprises dicalcium phosphate.

In general, the pre-coating step typically results in an overall increase in the density of pre-coated seed combination. The pre-coating step can be accomplished by, for example, spraying the pre-coating material onto the seed, and subsequently driving off such as by drying, as necessary, any solvent or other liquid carrier used for application of the coating material to the seed.
15

In yet other expressions, the invention comprehends a method of providing an enhanced seed germination environment in combination with placement of a controlled amount of plant nutrients in controlled proximity to each seed, the method comprising providing a population of seeds, coated with a soil conditioning material which tends to enhance germination of the seeds, and with plant nutrient composition effective to enhance growth of plant embryos emerging from the seeds; and placing the population of seeds on soil effective to support germination of the seeds. In such method, the coating material can include a second ingredient comprising plant nutrient moieties.
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Brief Description of the Drawings

FIGURE 1 is a transverse cross-sectional view of a coating drum suitable for spray-coating substrate seed according to the present invention.

FIGURE 2 is a partially cut away view showing a length of the drum of FIGURE 1.

FIGURE 3 is a schematic representative flow diagram illustrating a first manufacturing process for producing combination seed capsule product of the invention.

FIGURE 4 is a block diagram illustrating a second manufacturing process for producing combination seed capsule product of the invention.

FIGURE 5 is a schematic representative flow diagram illustrating a third manufacturing process for producing combination seed capsule product of the invention.

FIGURES 6A, 6B, 6C, and 6D show cross sections of seed capsules of the invention.

FIGURE 7 illustrates a cross-section of the soil root zone, and a representative population of seed capsules at the top surface of the soil.

FIGURE 8 illustrates a single seed capsule on the soil surface, and the micro-environment developing about the seed capsule.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

5 The following is a detailed description of the illustrated
embodiments of the present invention which provides combination
seed capsule products that provide for a combination of efficient
and proper seed placement in the soil, soil conditioning properties
at the specific site of the seed, plant nutrients at or near the
specific site of the seed, ingredients effective to reduce
deleterious effects of spore-formers and animals, and/or other
various physical benefits/properties of the combination seed
10 capsule not previously available in a single product.

15 In general, at least one seed substrate and at least one soil
conditioning material are selected as raw materials, and are
combined to make a combination soil conditioning seed capsule
product of the invention.

20 The invention can operate with any of a wide variety of soil
conditioning materials such as municipal or other sewage sludge,
scrubber sludge, paper mill sludge, fly ash, dust, animal waste,
other organic materials, and mineral soil conditioning materials.

25 The soil conditioning material can be a solid material having
a melting temperature so high that handling such material in the
melt state is impractical and/or undesirable in view of the limited
temperatures at which the seed will remain viable. For example,
the soil conditioning material may be combustible at a temperature
lower than its melt temperature, or will melt only above
temperatures which can be tolerated by the seed, such that
viability of the seed would be destroyed if melting were attempted
in an environment which exposed the seed to such temperatures.
Thus, handling such material in the melt state is impractical,
30 whereby other methods of handling the soil conditioning material
may be desired.

Solid sewage sludge, sawdust, and solid animal waste are
representative of soil conditioning materials which cannot be

readily melted. In the alternative, some soil conditioning materials such as sewage sludge, paper mill sludge, sawdust, and solid animal waste can be suitably comminuted and then dissolved or suspended in water or other solvent composition for processing purposes, optionally along with other soil conditioning materials and/or inorganic chemical fertilizer materials, and the solvent subsequently driven off to make a resulting solid product.

Inorganic chemical fertilizers generally are distributed in commerce as solid state materials. Such material is generally produced in manufacturing steps either in solution or in the melt state to meet a specified narrow range of size, hardness, and plant nutritional characteristics, distinct to the application of each such product. Examples of such fertilizers include nitrogen, phosphorus, and potassium containing products such as urea, monoammonium phosphate, diammonium phosphate, superphosphate, triple super phosphate, dicalcium phosphate, potash, and the like. The inorganic chemical fertilizer can be a mixture or other physical combination of known inorganic fertilizer chemicals, and may include desired amounts of micronutrients such as sulfur, manganese, copper, boron, iron, zinc, and the like.

In preferred embodiments of this invention, a precursor seed capsule, having one or more coatings of the soil conditioning and/or other material thereon may first be prepared as a solid or semi-solid particle or agglomerate. The soil conditioning raw material may be a particulate powder, or may be fibrous, or may be a suspension of a powder or fibrous material in a liquid carrier, and is preferably coated onto the substrate seed to form a seed capsule or other agglomeration of particles, fibers, or the like. Where the soil conditioning material is, for example, sewage sludge, the sewage sludge raw material can be obtained as a slurry that may be bound together as with a binder, preferably an organic binder, when dried. The slurry may be spray-applied to the substrate seeds, for example to a rolling bed of such seeds, in

combination with a flow of air to evaporate water from the thus-applied coating. Such sewage sludge, or paper mill sludge, need not be reacted or otherwise treated with any acid, caustic, or any other chemical before being applied and/or dried, or partially dried, either in preparation for, or after, the slurry application of the sludge to the seed substrate.

Specifically, the sewage sludge or paper mill sludge used herein as soil conditioning raw material need not be treated to transform such sludge into colloidal form. Thus, the sludge preferred for use herein is generally non-colloidal in nature, and is distinguished by its non-colloidal nature from conventional sludges which are specifically treated to provide the colloidal characteristics thereto.

Natural lignin, lignosulfonates, and the like, may serve as suitable binders where the soil conditioning material is, for example, paper mill sludge, raw wood, sewage sludge, or other organic or inorganic material. In the case of, for example, calcium chloride or other inorganic additives, such materials may be added to the primary coating, e.g. onto or into the sludge coating, by well-known processes.

Soil conditioning material used herein may be devoid of such conventional plant nutrients as nitrogen, potassium, and phosphorous, or may have such limited plant nutrient value, or may be so unbalanced in nitrogen, phosphorous, and potassium content, that the soil conditioning material may not, by itself, be a desirably complete material for use as the only ingredient in the seed coating. Thus, such soil conditioning material may have limited application herein where basic level of soil fertility is seriously degraded. However, all soil conditioning materials contemplated herein beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the seed, this

invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

Further to preferred embodiments, typically a first coating material (e.g. soil conditioning material) is readily converted into liquid state such as liquid suspension, and is provided to the process as a liquid. As a general statement, the first coating material may be sprayed onto the substrate seed, then is converted back to solid state on the thus-created seed capsules or seed capsule precursors. In the alternative, the coating material may be mixed with the seed in an (e.g. ribbon) blender, or may be otherwise coated onto the substrate seed in an agglomeration process according to well-known conventional agglomeration principles.

Regarding the coating process, the coating material can accumulate as a single or multiple layer coating on the outside of the seeds to form a population of combination seed capsules. The layer or layers of coating material can be a homogeneous or heterogeneous mixture of the desired elements. Further, such population of combination seed capsules can have a range of hardnesses and thicknesses for improved seeding treatments.

Cooperating inner and/or outer layers may be used e.g. to control direct contact between the seed and moisture. Suitable materials and processes therefore are taught in USA Patent 3,698,133 Schreiber and 4,759,151 Gerber, and are thus well known in the art.

In some embodiments, a second coating material may penetrate into the layer of soil conditioning coating material. Such penetration may comprise a generally uniform distribution of the second coating material throughout the first coating material, or

may represent a more stratified or otherwise heterogeneous distribution of second coating material in or on the first coating material.

In other embodiments, the coating materials may be mixed into a heterogenous layer. Such layer or layers of heterogenous material can then be coated upon the outside surface of the seed.

Where the liquid state of a coating material was obtained by slurring or otherwise combining the coating material with water, the liquid fraction is reduced after application of the liquid-state material to the substrate seed, or to the growing seed capsule, to effect solidifying of the coating material after application of the coating material to the substrate seed. The liquid fraction is reduced by driving off the liquid carrier, as by medium or low temperature air, or vacuum or other flash drying, after or during application of the coating material to the substrate seed. The resulting solid seed capsule, comprising the seed coated with the e.g. sludge coating material, is then recovered as a combined soil conditioning seed capsule product of the invention.

Spraying of the liquid coating material can be accomplished by a variety of known processes such as, but not limited to, pneumatic, hydraulic, or electrostatic spraying processes. The temperature and pressure of the material being sprayed depends on the material selected, and the viscosity and other parameters of the respective material in the respective liquid state. While high atomization is desired, such is not critical. The liquid coating material need only be atomized sufficiently to provide a generally uniform coating on the substrate seeds, as determined after the coating and solidification steps in fabricating the seed capsule product are completed.

Indeed, the uniformity of coating or coating thickness about the seed is typically not critical so long as the seed is not on or immediately adjacent an outside surface of the capsule such that

the seed may fall out, or be easily broken out, of the capsule, or easily removed by dissolution of materials at and near the surface of the seed capsule. In addition, the seed should not be so near the outside surface of the capsule as to be in a nutrient layer having such high concentration of nutrient as to be toxic or otherwise detrimental to viability or growth of a plant emergent from the seed.

Spray application of the coating is suitably controlled to achieve the required addition of the spray material, liquid and/or powder, coating to the substrate seed or precursor seed capsule. An illustrated method of applying the liquid material to the substrate seed or precursor seed capsule is by using a rotating drum spray-coating apparatus. Other apparatus and methods, for example a tilted pan coating process, can be used to apply the soil conditioning material and optionally an inorganic chemical fertilizer material onto the substrate seed. The coating operations can be batch operations or continuous operations.

As illustrated in FIGURES 1, 2, and 4, spray apparatus can operate within a rotating drum disposed in a generally horizontal orientation. The drum may incorporate internal lifting flights which lift free-flowing (e.g. seed and growing seed capsule) particles in the drum and then let the particles fall to the bottom of the drum as a continuously falling curtain or cascade. In some embodiments, the interior of the drum is either clean and free from any flighting, or has only mixing fingers or flights that expand the area covered by the bed, that keep the bed rolling as the drum rotates, and that generally improve mixing, rather than lifting particles to the top of the drum and then releasing them in a falling cascade. However, such lifting of particles to the top of the drum, and corresponding falling cascade or falling curtain, are not excluded from processes of the invention. Rather, both such finger mixing, and such lifting coupled with falling cascade or curtain, are included within the scope of the invention.

Stationary spray nozzles are positioned within the drum to project the sprayed material onto the rolling bed, and optionally onto any curtain or cascade of falling particles. For a continuous process, the drum is preferably inclined at a small angle from horizontal, such as, without limitation, about 0.25 inch to about 0.38 inch from the horizontal for each foot of length of the drum, so that rotation of the drum causes the particles to move from the inlet end of the drum to the discharge end, while maintaining a relatively uniform bed thickness. The optimum degree of incline varies with each set-up and may thus be outside the above range. The important parameter is that the incline contribute to maintaining a bed of seed and seed capsule particles having sufficient uniformity that the spray material can be effectively applied to the particles passing through the drum. The particles are then discharged at the discharge end of the drum.

FIGURES 1 and 2 show schematically a first embodiment of processing equipment which may be used to produce seed capsules of the invention. Such processing equipment includes a drum and sprayer combination suitable for continuously producing coated seed capsules in accord with the invention. Use of the illustrated drum and sprayer combination is not critical, however, as other drum and sprayer combinations, or other coating methods such as pan coating methods, are also suitable. In FIGURES 1 and 2, drum **10** has an inlet end **12** for receiving the substrate seed material or materials, or partially formed or pre-coated seed capsule precursors. Drum **10** has a discharge end **14** through which agglomerated or otherwise coated seed capsule product particles are discharged over discharge retaining ring **16**. A variable speed rotary drive (not shown) is provided for supporting and rotating the drum **10** in a counterclockwise direction as viewed in FIGURE 1 at controlled, and changeable drive speeds. Conventional slope adjustment apparatus (not shown) is provided for routine and ongoing adjustment the slope of the drum from horizontal.

Air is preferably supplied from discharge end **14** as shown in FIGURE 2, and flows countercurrent to the direction of travel of the seed substrate material. Since the contemplated coating materials are generally applied to the seed in liquid, or semi-liquid, or other moist form, and since some coating materials may thus tend to form clumps or otherwise self-agglomerate when exposed to ambient moisture conditions, air supplied at discharge end **14**, and elsewhere in the process for contact with the coated seed and seed capsules, is preferably dried in order to cost-effectively remove an optimum amount of the moisture from the coating material and to assist in maintaining suitably low moisture content in the thus coated and dried seed capsules.

A first stationary spray assembly **28** extends longitudinally within drum **10** above and adjacent the bed **20** of seed and/or seed capsules. First spray assembly **28** includes pipe **29** and nozzles **30**. A second spray assembly **32** extends longitudinally within drum **10** generally adjacent first spray assembly **28**. Second stationary spray assembly **32** includes pipe **33** and nozzles **34**, which transport the material to be sprayed. Nozzles **30** and **34** are connected to pipes **29** and **33** respectively, and project sprays of liquid or otherwise particulate coating material toward the bed of seeds and/or seed capsule precursors. The description of spray assemblies **28**, **32** as stationary means that the spray assemblies do not rotate with drum **10**. However, the positions of either nozzles **30**, **34** or pipes **29**, **33**, or both, can be adjusted within the drum for proper direction of the respective spray or sprays onto the bed of seeds and/or seed capsules or seed capsule precursors.

A stationary protective cover **24** is mounted over the spray assemblies. Seeds and/or seed capsules falling from the inner surface of the drum and the flights, above the spray assemblies, fall onto the cover, and are deflected away from the spray assemblies, as shown in FIGURE 1. Thus, cover **24** protects the

pipes and nozzles from the falling seeds and seed capsules falling onto and fouling the pipes and spray nozzles.

As drum **10** rotates, flights **22** lift and mix the seeds, seed capsule precursors, and seed capsules, but do not generally carry the bulk of the seeds and seed capsules up to the top of the drum. Some small amount of seeds, seed capsule precursors, and seed capsules will be carried upwardly to the top of the drum by even a drum devoid of any flights. Thus, all drums experience some amount of seeds and seed capsules falling from the upper part of the rotating drum whereby cover **24** is beneficial for protecting spray assemblies **28** and **32**.

Preferred flights **22** are primarily directed toward enhancing mixing of the bed **20** of seeds and seed capsules, continually refreshing the surface of the bed with a newly-emergent supply of seeds and seed capsules, rather than lifting and subsequently dropping the seeds and seed capsules which may be fragile when initially coated. To that end, each flight **22** preferably, but without limitation, has a leading surface **23A** extending at an obtuse angle "A1" of at least 90 degrees with respect to the inner surface of the drum. A more preferred angle "A1" is about 100 degrees to about 150 degrees. Trailing surface **23B** of flight **22** can be virtually any angle, with the inner surface of the drum, which angle does not interfere with the operation of adjacent leading surfaces **23A**.

Additional retaining rings can be added to the assemblage shown in the drawings, in order to provide that height "H" to the retaining ring which will provide and maintain the optimum configuration of bed **20** inside drum **10**.

As noted above, inlet end **12** of the drum may be raised above discharge end **14**. When in use, the drum rotates continuously. Seeds or previously thinly-coated or partially-coated seed capsules are continuously fed into inlet end **12** and thus added to rolling bed **20**. Flights **22** continuously mix the bed as the drum rotates,

refreshing the bed surface with newly fed seeds, or seeds and seed capsules newly brought to the surface by the continuous rotation of the drum in combination with the mixing action of the flights. Spray assembly **28** sprays the desired coating material (e.g. sewage sludge, paper mill sludge, or other coating composition, onto the continuously moving and mixing surface of bed **20** from a plurality of nozzles **30** distributed along the length of pipe **29**, and similarly along the length of drum **10**, adding the sprayed material to the seeds and seed capsules in bed **20**. After receiving the spray coating from spray assembly **28**, the seed capsules are discharged through discharge end **14**. In some embodiments, the seed capsules pass through a cooling chamber, not shown, integral in drum **10**, before being discharged through discharge end **14**.

In general, as the seeds traverse the drum, from inlet to discharge, nozzles **30** atomize the liquid or other coating material and spray such atomized coating material as e.g. droplets of the coating material onto the seeds in the bed. The result is that the seeds become generally uniformly coated with one or more layers of the coating material such that the coating material becomes an integral part of the respective seed capsules fabricated in the drum. As the coating material solidifies on the seeds, the coating material tightly bonds to the respective portions of the seeds.

As the seeds and seed capsules roll and mix with rotation of the drum, the incline of the drum causes the seeds and seed capsules to travel from inlet end **12** toward discharge end **14**.

In the alternative, or where a coating material is not readily self-bonding to the seed material, a binder material can be provided toward the inlet end of the drum at spray assembly **32**, through pipe **33** and nozzles **34**. In such embodiment, the binder is preferably sprayed onto the seeds closer to inlet end **12** rather than along the entire length "L" of the drum. The coating material is then preferably sprayed onto the seeds downstream from the inlet end, and preferably relatively downstream of nozzles **34**. Thus, the

seeds receive a first coating of the binder, and a subsequent second coating of e.g. liquid soil conditioning coating material overlying the binder.

Binder material applied as e.g. through spray assembly **32** may contain additional coating components such as e.g. flyash, lime, gypsum, or the like, as one or more components for assisting in adding bulk and thickness to an inner binder layer prior to any, or the majority of, the application of the organic coating material (e.g. sewage sludge or paper mill sludge).

In some embodiments, binder and liquid soil conditioning coating material are applied at similar locations along length "L" of the drum whereby binder and soil conditioning coating material may become intermingled/mixed before reaching the seeds, or on the seeds. For example, liquid soil conditioning coating material may be sprayed onto the seeds along the full length of the coating chamber in drum **10** while spraying of the binder material onto the substrate seeds is done relatively closer to or adjacent the inlet end of the coating chamber of the drum. Thus, a first binder layer may underlie or be mixed with the soil conditioning coating material, and may be overlain by a second layer of the soil conditioning coating material. Thus, in this embodiment, the binder layer may typically be a combination of binder material and coating material.

Further, it is contemplated that the soil conditioning coating may be applied first, followed by application of binder or inorganic fertilizer or sealer coating, in which case the binder or inorganic fertilizer or sealer may serve as an outer shell, temporarily trapping the inwardly-disposed materials inside the seed capsule. In the alternative, the soil conditioning coating may be applied first, followed by application of the binder, and wherein the binder penetrates through the soil conditioning coating, either physically or chemically, to the underlying substrate seed and there provides the binding property.

Additional spray assemblies can be provided, spraying additional materials (e.g. inorganic fertilizer materials) onto the substrate seed. Thus, e.g. 6 spray assemblies can spray 6 different coating materials onto the substrate seed. For example, a first spray material can be a binder or primer material intended primarily to enhance bonding of subsequent sprays to the substrate seed. Continuing the example, a second spray can be a combination of binder and finely comminuted particulate material such as lime and/or flyash. A third spray may be a soil conditioning material such as a paper mill sludge or a municipal sewage sludge. Fourth, fifth, and/or sixth sprays can add nitrogen, phosphorous, and/or potassium plant nutrient ingredients, alone or in combination, or as combinations. In this manner, the soil conditioning properties of the seed capsule can be established, and the plant nutrient level of the seed capsule can be enhanced to provide substantially any level of major and/or minor plant nutrients desired in the seed capsule, at substantially any relative ratios of the respective plant nutrients, and wherein the preferably primarily soil conditioning coating provides desired soil conditioning properties in the resulting product, initially for use by the specific seed contained therein, and ultimately as additive to the overall tilth of the growth medium such as soil into or onto which the seed capsule is eventually planted.

A preferred, and rather simplistic, embodiment of the invention is provided by spraying a soil conditioning liquid suspension of sewage sludge or paper mill sludge onto seeds to be encapsulated to make seed capsules. By controlling the amount of the soil conditioning sludge, or by controlling the residence time of the seeds in the drum, a desired thickness of soil conditioning coating can be provided in the resulting coated product.

Typical dried sewage sludge, as a raw material, contains about 2-6% nitrogen, up to about 2% phosphorous, and generally no potassium, and thus has little or no market value as a fertilizer

(plant food) product per se. However, by adding e.g. urea, the nitrogen content can be raised if desired, especially as a coating on or adjacent the outside surface of the seed capsule, whereby the combination fertility-enhanced, soil conditioning, seed capsule product has real market value as a comprehensive, self-contained, value-added, seed capsule product. Such product thus contains the seed, a soil conditioning composition which operates somewhat as a seed incubator providing a beneficial germination environment, and a starter quantity of fertilizer selected in quantity and placed in location so as to provide improved, ideally optimum, amounts of plant nutrients at optimum location for use by the newly-emerged embryonic plant at the germination stage of seed development.

Starting with a sludge coating having 2% by weight nitrogen, sufficient urea may be added to bring the nitrogen content to, for example, 5%, 7%, 8% or 10% nitrogen, or more, depending what analysis is desired. Starting with a sludge coating having 6% nitrogen, sufficient urea may be added to bring nitrogen content to, for example, 10%, or whatever other analysis is desired. Phosphorous and/or potassium components and/or materials having combinations of plant nutrient elements (e.g. NPK) can, similarly, be added to the sludge, either before, after, or during addition of the urea. In addition, nitrogen, potassium, and/or phosphorous-containing materials can be combined with the sludge prior to the sludge being applied to the seed.

It should be understood that the more porous the established soil conditioning coating, or e.g. the outer surface of such coating, the more any subsequent spray material penetrates the established coating. All such penetration is contemplated in use of the term "coating" herein.

In some preferred embodiments, the overall coated combination seed capsule product comprises seed capsules wherein substantially the entirety of the soil conditioning material is confined to a contiguously-defined portion of the seed capsule. In such

embodiments, the structures of the finished product seed capsules comprise coatings of contiguously arranged elements of the soil conditioning material, generally arrayed entirely or substantially entirely about the seed, which coatings may be overlain by an additional layer, optionally discontinuous, of organic or inorganic chemical fertilizer. Further coating layers of either soil conditioning material or organic or inorganic chemical fertilizer can be applied over the additional layer.

In addition, or in the alternative, other layers of other materials whether soil conditioning materials, organic or inorganic fertilizers, or other materials, can be applied to the substrate seed before applying the above mentioned layer of soil conditioning sludge. Thus, the substrate seed can be coated with a layer of a calcium compound e.g. calcium chloride, calcium carbonate, or dicalcium phosphate, or with a sulfur moiety, and/or a further layer of urea, all with optional use of binder materials.

Further to the structure of the seed capsules of the invention, the coatings on the seed capsules need not generally represent a uniform mixture of the inorganic chemical fertilizer and the soil conditioner. Rather, in a typical seed capsule a core substrate seed is overlain or encapsulated by a soil conditioning material, and is generally free from a second overlying soil conditioning coating material, and wherein the inorganic fertilizer content at the seed/coating interface is relatively higher so as to represent a second coating material such as an inorganic fertilizer coating, as compared to the inorganic fertilizer content at locations at and adjacent the seed.

The second coating can, and preferably does, in some embodiments, penetrate into voids or other interstices in an underlying e.g. soil conditioning coating. However, preferably most if not all elements of the underlying e.g. soil conditioning coating material are generally interconnected with each other without intervening coating material of the second layer, except

for an optional binder used to hold the first coating material together as a unitary structure, separate from any structure and bonding provided by the second coating material.

5 While the combination seed capsule can comprise discontinuities in the soil conditioning sludge coating layer, in combination with an inorganic fertilizer material in such seed capsules, such compositions are less preferred.

10 Regarding the coating process, FIGURE 4 illustrates in flow sheet form a manufacturing process for producing seed capsules of the invention, using the coating drum **10** as described above. It should be understood, however, that other equipment such as a pan pelletizer, a paddle mixer, or the like can be used in place of the rotary drum to obtain combination seed capsules of the invention.

15 The coating process operates according to conventional and generally well known agglomeration principles, as described by Wolfgang B. Pietsch in an article entitled "The Agglomerative Behavior Of Fine Particles." Such coating process uses water and heat, along with physical and/or chemical adhesives and like properties, to bind or agglomerate a plurality of types of particles and/or materials into coated seed capsules, each typically containing an individual seed.

20 To obtain agglomerates from relatively smaller particles of raw materials, binding forces must act within the individual developing agglomerate particles. According to known agglomeration principles, five different binding mechanisms are known to be useful for building agglomerate particles including solid bridges, interfacial attractions and capillary pressure, adhesion and cohesion, attraction between solid particles, and form-closed bonds.

25 30 At elevated temperatures, solid bridges can form by diffusion of molecules from one particle to another at the points of contact. Heat can be introduced from an external, secondary source or created during agglomeration by friction and/or energy conversion.

Solid bridges can also be built up by chemical reaction, crystallization of dissolved substances, hardening binders, and solidification of melted components.

5 Capillary pressure and interfacial attraction forces in liquid bridges can create strong bonds that disappear if the liquid evaporates and no other binding mechanisms take over.

10 Highly viscous bonding media such as tar and other high molecular weight organic liquids can form adhesive and/or cohesive bonds very similar to those of solid bridges. Thin adsorption layers are immobile and can contribute to such bonding together of fine particles under certain circumstances.

15 Typical short-range forces of the van der Waals electrostatic or magnetic type can cause attraction between solid particles whereby the particles stick together if such particles are sufficiently close to each other. Decreasing particle size clearly favors such attraction between solid particles.

Fibers, little platelets or bulky particles can interlock or fold about each other resulting in "form-closed" bonds.

20 Now referring to FIGURE 3, in some embodiments of the coating/agglomeration process, it is desirable to pre-coat the seeds prior to implementing agglomeration principles to produce the above described coating of soil conditioning material. Such embodiments comprise light-weight and/or elongate shaped seeds (i.e. grass seeds), or other similar type of seed which may not
25 readily or inherently serve as a nucleating agent in a conventional agglomeration process with the respective soil conditioning material which is desired to be coated on the seed. Pre-coating the grass seed, for example, enhances the agglomeration of paper sludge as a coating material, of binder and/or of other coating
30 substances, by increasing the weight of the pre-coated grass seed and by providing a more filled in, more rounded shape to such long and narrow seeds. The increased weight and more filled in shape of the grass seed enables more effective, more efficient, processing

of the seed in coating apparatus such as that illustrated in FIGURES 3 and 4.

Referring to FIGURE 3, the form and composition of such pre-coating, when needed, can vary according to the weight, shape, composition, and surface properties of the seeds, and according to the binder, if any, the soil conditioning coating or coating materials to be applied, and any other inorganic or organic coating material to be applied.

The seeds, whether pre-coated or not, are received within the rotary drum where the soil conditioning material is spray coated onto the substrate seeds to obtain combination seed capsules.

Before coating the seeds with a soil conditioner, the organic soil conditioner material (e.g. paper sludge) is preferably processed through a dryer such as a rotary drum dryer, as needed, to reduce the amount of moisture in the organic soil conditioner material to less than about 8% water by weight. Such drying is an essential step where the material is otherwise above the nominal 8% effective water content, to enable grinding the sludge to a size less than US Standard 20 mesh screen, and to prevent the particles from agglomerating with each other. Certain of the coating materials, e.g. fly ash, because of their physical properties, need not be dried before being ground to a suitable size for participating in the agglomeration operation.

The seeds, whether pre-coated or not pre-coated, and the one or more soil conditioners, are received within a mixer where growth enhancers such as time release agents and/or other environmental conditioners may be added to form a combination seed capsule. The thus pre-coated seeds are then received into a pan pelletizer, a rotary drum, or the like, where binders such as lignin, lignosulphonates, molasses, sodium silicate, wax, monammonium phosphate, or urea can be added and thereby coated onto the pre-coated seeds. Other materials which can be added to the seed capsule at the e.g. rotary drum include anti-fungal coatings such

as with metalaxyl fungicide, for example, Apron® and/or Subdue®, available from Novartis, Inc. of Greensboro, North Carolina.

5 The such-coated seeds are then passed into a rotary or other dryer in order to obtain a seed capsule containing 5% or less water. The maximum water fraction in the coating can vary according to the composition of the coating material, so long as the resultant seed capsules remain suitably structurally strong and so long as a population of such coated seed capsules remains free flowing in solid condition. The process for fabricating the seed
10 capsules must maintain a temperature sufficiently low that the seeds are not heated so hot that viability of the seeds, for germination purposes, is not dramatically compromised. It is generally preferred that the temperature of the seeds be suitably controlled such that any binder and/or coating material, or other materials applied to the seeds, cool at a controlled rate while bonds form between the seeds, or seed capsule precursors and the one or more soil conditioning and/or other coating materials. Such temperatures of all materials are suitably controlled to avoid decomposition of the respective materials, loss of viability of the seeds, or breakage of seed capsules or seed capsule precursors, or coatings or coating or other materials during such processing. The temperature at the rolling seed bed inside drum **10** generally can range from about 130 degrees F to up to at least 230 degrees F for seed residence times up to at least 1 hour. At drum operating
20 temperatures of less than 130 degrees F, drying time can become excessive. At temperatures above 230 F, the viability of the seed may be at risk, depending on the sensitivity of the seed, residence time, and other influential parameters.

25 The above stated temperature range is illustrative and not limiting, and will vary depending on the seed, the coating materials, and the specific process parameters of a particular coating system and coating operation. Thus, maximum e.g. drum coating temperatures can be less than 130 degrees F or more than
30

230 degrees F. However, the stated range is preferred, including all temperatures within such range such as, for example, 150 degrees F, 180 degrees F, 210 degrees F, and the like.

5 Referring to the drum of FIGURES 1 and 2, and to the pan pelletizer block in FIGURE 3, the seeds are fed continuously to an inlet as at inlet end **12** of drum **10**. Combination seed capsules, produced as described above, are released from a discharge locus such as discharge end **14** of the drum to a sizing apparatus **36** in which the seed capsules are sized through conventional sizing elements. Suitably-sized seed capsules are discharged from the 10 sizing apparatus as product for distribution. Undersize seed capsules are fed back into mixer as shown in FIGURE 3. Oversized seed capsules are fractured and screened for reprocessing.

15 The recovered seed product can be further coated with any of the coating materials described above, such as urea or other inorganic or organic fertilizer, and/or with growth enhancers or other desirable materials. Further, other types of coating materials such as water repellants can be coated onto the discharged seed capsules for the purpose of imparting additional 20 desirable properties to the seed capsules.

25 In the process of coating porous organic materials such as sewage sludge or paper mill sludge as is optional in the invention, with a second material which is applied for other than imparting soil conditioning properties, for example an inorganic fertilizer, the general size of the coated seed capsule may be the same after applying the second material (e.g. inorganic fertilizer) as the size of the previously-coated seed capsule, or may be similar in size. Namely, the quantity of coating material added to the seed capsule can be so small as to not materially affect seed capsule 30 size, or the coating material can be received into an e.g. porous interior of the soil conditioning coating of the seed capsule, or both.

It is contemplated that the operation and functions of the invention have become fully apparent from the foregoing description of elements, but for completeness of disclosure, the usage of the invention will be briefly described.

EXAMPLE 1

A coating drum as illustrated in FIGURES 1, 2 and 4 is used to place a coating of paper mill sludge on grass seed. Raw material grass seed about 4-6 millimeters long and about 0.5-1.0 millimeter thick, is continuously fed to pre-treater **11**, where the seed is blended with powdered lime, powdered flyash, and a lignosulfonate binder, to form partially-developed seed capsules comprising seeds coated with relatively thinner coatings of the recited mixture of coating materials. The partially-developed seed capsules are continuously fed to inlet end **12** of drum **10**, to form a bed **20** of the partially-developed seed capsules. The drum rotates continuously. The rolling of the drum, and the associated mixing affect of the flights, provide a constantly changing top surface of the bed. A paper mill sludge slurry is supplied in pipe **28** at pressure sufficient to atomize the liquid sludge slurry. A liquid sludge slurry is thus sprayed from nozzles **30** onto the top surface of the bed of partially-developed seed capsules, applying a sludge coating on those partially-developed seed capsules which are at the upper surface of the bed at any given point in time.

The resulting seed capsules, of paper mill sludge coated seeds, have a coating of soil conditioning sludge thick enough to make the material a product marketable for its soil conditioning content as well as for the seeds contained therein. Increased levels of nitrogen and/or other plant nutrients can be added by, without limitation, providing sprays of the other desired materials, preferably subsequent to at least the initial sludge slurry spray. Other materials can be included in one or more of

the sprays e.g. to retard or enhance moisture permeation into or out of the combination product in accord with the anticipated storage and/or use environment of the product.

EXAMPLE 2

FIGURE 5 illustrates the equipment used in this EXAMPLE 2. As seen therein, grass seed, lime, flyash, and calcium lignosulfonate binder are fed to ribbon blender **111** by respective screw feeders **112A**, **112B**, **112C**, **112D** respectively. Ribbon blender **111** encapsulates the seed with a thin layer of the mixture of lime, flyash, and lignosulfonate to thereby make partially-formed seed capsules. The partially-formed seed capsules are discharged from the ribbon blender and conveyed by conveyor **114** and belt feeder **116** to a tilted-pan pelletizer **118**, which rotates about a fixed axis.

Paper mill sludge is received into a weigh hopper **120** at about 60% by weight water, and is fed by screw feeder **122** and belt **124** to pin mixer **126**. The pin mixer breaks down the fiber and fiber clusters of the sludge into loose separate fibers, and discharges the resultant material onto conveyor **128** which transports the material to screw feeder **130**, and thence into the tilted pan pelletizer.

In the tilted pan pelletizer, the partially-formed seed capsules, (seeds being coated with lime, flyash, and lignosulfonate) are mixed with the comminuted paper mill sludge and thereby coated with the sludge. By operation of the tilted rotating pan pelletizer, the larger seed capsules generally rise to the top of the bed of seed capsules in the pan, and as additional material (sludge and partially-formed seed capsules) are added to the pan, the larger seed capsules overflow the lower edge of the rotating pan, onto vibrating feeder conveyor **132**.

The vibrating feeder conveyor feeds the seed capsules into granulator **134** (e.g. rotating drum) where the seed capsules may be

(e.g. spray) coated with inorganic fertilizer or other desired material.

From the granulator, the seed capsules flow into dryer 136 and are dried to a final product moisture of about 2-3% by weight water. The resultant product is then screened and sized as before, with undersized and oversized product seed capsules being recycled for further processing.

Urea and other liquid inorganic chemical fertilizers can, as indicated, be used as binders to bind together soil conditioning coatings which are not readily self-bonded together. In such embodiments, the urea or other liquid fertilizer composition serves as the binder or glue which holds together the soil conditioning material which is used as the coating. Other binding materials may be used either alone or in combination with the inorganic chemical fertilizer. Any plant nutrient components of the binder/glue composition contribute to the plant nutrient value, e.g. nitrogen, phosphorous, and/or potassium, provided by the so-made seed capsules. Thus, a binder/glue, or a multiplicity of binders/glues, properly selected as to nutrient value can provide, in the finished product, significant contribution to any desired fertility analysis.

A primary purpose of soil conditioning products is to condition the soil in terms of properties other than direct provision of plant nutrients.

The primary purpose of conventional inorganic chemical fertilizer products is to directly provide plant nutrients. It is well known that highly purified forms of inorganic chemical materials are more concentrated than desired in close or intimate proximity with seed, in the growing medium. Thus, inorganic chemical fertilizers can be diluted in concentration and still have sufficient nutrient content to be highly useful additives in soil conditioning seed capsules of the invention. It is common practice

to modify and thus dilute inorganic chemical fertilizer products with filler materials that do not provide plant nutrients, in order to provide less concentrated fertilizer products. To the inventor's knowledge, such diluents, however, do not include soil conditioning products, especially not organic soil conditioning products.

It is conventionally known to apply commercially available soil conditioning materials and inorganic fertilizers, in separate applications, to a given common plot of soil to assist the soil in growing a crop. For example, it is known to make a first broadcast or other placement of lime to control pH of the soil, followed by a second broadcast and/or row-applied placement of granular inorganic chemical fertilizer. It is also known to make sequential applications of a soil conditioning material such as fresh or aged manure followed by inorganic fertilizer, all of which may be separate from the step of applying seed. And where seed is indeed applied in the same step, the seed and soil conditioner are not intimately bound in controlled positioning with respect to each other in common in individual particles of the product so applied, as in the invention.

To the inventor's knowledge, it is not known to apply soil conditioning material and inorganic chemical fertilizer in a common carrier/particle. Nor is it known to apply seed in a seed capsule wherein the seed is intimately combined with a soil conditioning material in a common particle, optionally with an inorganic fertilizer component in controlled positioning with respect to the seed in the same capsule as a seed-soil conditioning particle.

In those embodiments of the invention comprehending both soil conditioning and inorganic fertilizer in the same seed capsule/particle, the ratio of soil conditioning material to inorganic chemical fertilizer material can vary, from, for example, about 80% by weight up to less than 100% by weight soil conditioning material, with corresponding greater than 0% up to

about 20% by weight inorganic chemical fertilizer. Generally, the invention as practically applied, however, is somewhat more narrowly defined, because the practical benefits of the invention are achieved at more balanced combinations of the soil conditioning material and the inorganic chemical fertilizer.

Thus, a preferred amount of soil conditioning material is about 90% by weight to about 98% by weight soil conditioning material, in combination with about 2% by weight to about 10% by weight inorganic chemical fertilizer. To the extent the soil conditioning material is present in amount less than about 80% by weight, the corresponding 20% by weight organic fertilizer in such close and intimate proximity to the seed may be toxic to the seed. To the extent the inorganic fertilizer is present in an amount of less than 2% by weight, the beneficial fertility affects of the fertilizer may not be perceived.

To the extent the inorganic fertilizer can be confined in a layer displaced from the seed, a higher level of inorganic fertilizer may be used while limiting risk of a toxic response from the seed. Referring now to FIGURES 6A-6D, in the embodiment of FIGURE 6A, seed capsule **38A** comprises a seed **40A** coated with a single generally homogeneous coating **42A**. Coating **42A**, as illustrated in FIGURE 6A, may comprise only the soil conditioning material (e.g. paper mill sludge or sewage sludge), or may comprise both the soil conditioning material and an inorganic fertilizer or other inorganic material generally dispersed in coating **42A**.

In FIGURE 6B, seed capsule **38B** comprises a seed **40B** coated with a first layer **42B** of soil conditioning material. A second coating material is shown penetrated part-way through the first layer **42B**, thus to make a combination outer layer **44B** comprising the combination of the material of layer **42A** and the material of the second material, such as inorganic fertilizer.

In FIGURE 6C, seed capsule **38C** comprises a seed **40C** coated with a first layer **42C** of soil conditioning material. A second

generally separate and distinct layer **46C** of a second coating material (e.g. inorganic fertilizer) is disposed outwardly on the underlying first layer **42C**. Layer **46C** generally does not penetrate layer **42C**, whereby higher levels of inorganic fertilizer may be used because of the effective displacement distance between the seed and the second layer **46C**. The second layer may be prevented from penetrating the first layer by applying e.g. an intervening layer which repels the second layer, for example wax, lignin, or the like.

In FIGURE 6D, seed capsule **38D** comprises a seed **40D** coated with a pre-coating layer **48D** of dicalcium phosphate to densify and configure the seed capsule precursor for the primary coating steps in drum **10** or pan pellitizer **118**. Layer **42D** of soil conditioning material is disposed outwardly of pre-coating layer **48D**. Other materials such as at layers **44B** or **46C** can be added to any of the embodiments, including that of FIGURE 6D to provide the properties associated therewith.

In alternative embodiments, seed capsules can comprise a seed coated with at least one heterogenous layer. The heterogenous layer comprises at least two different materials substantially commingled, uniformly or non-uniformly, within a single layer. Such materials can include, for example, soil conditioning material and inorganic fertilizer, micronutrients, herbicides, fungicides, binders and/or any other layer material contemplated by the present invention.

While the soil conditioning material/sewage sludge or paper mill sludge may contain a nominal amount of nitrogen and lesser quantities of phosphorous, potassium, and micronutrients, these small levels of plant nutrient content are generally not high enough for the plant nutrients to be considered a primary commercial asset. Yet only small nutrient amounts are desired so close to the seed. Thus, in some uses, the nutrient content of the sludge may be fully acceptable as the sole coating material on the

seed in making suitable and acceptable seed capsules of the invention.

Products of the invention offer a new combination of properties, namely readily available excellent soil conditioning properties in combination with the seed in a seed capsule wherein size and density of the seed capsule are controlled to the desired size and weight.

One of the properties offered by soil texture conditioners such as sewage sludge and paper mill sludge is that of maintaining soil condition by retaining moisture in the soil, retarding leaching of soil nutrients from the root zone, and attenuating hardening, clumping, or other hard agglomeration characteristics of the soil, which harder soils are more difficult for plant roots to penetrate than are softer soils. Thus, improving the soil texture condition, soil tilth, increases the efficiency with which plant nutrients are retained and used for plant nutrition, as well as generally improving the environment of the soil to accommodate, and readily receive, root growth.

When soil conditioning materials and plant nutrients are applied separately to the soil, as in the prior art, the ratio of applied plant nutrients to applied soil conditioning material typically varies widely according to variations in the uniformity of the two applications of the two materials. Further, the soil conditioning material is generally not closely associated with the plant nutrient-containing fertilizer in the soil, and certainly neither soil conditioner nor the fertilizer are controllably-closely associated with the seed, such that nutrient absorption benefits provided by the soil conditioning material are not assuredly associated with respective particles of inorganic chemical fertilizer materials, and neither the soil conditioning material nor the inorganic fertilizer is controllably and intimately associated with the seed as in a common capsule or other particle as in the invention.

5 Rather, where soil conditioning and fertilizer materials are applied in separate applications and/or in applications separate from the application of the seed, the bulk of the soil conditioning material and the bulk of the inorganic chemical fertilizer are generally at least somewhat separated from each other in space, and physically separated from the seeds, such that potential cooperative benefit of the soil conditioning material as relates to solvation and up-take of soil moisture and/or of the inorganic chemical fertilizer by the seed are not obtained, and/or are not
10 obtained in controlled close association with the seed.

15 When the soil conditioning material, the inorganic chemical fertilizer materials, and the seed are separately applied to soil with different sets of equipment, the respective rates of application vary such that the desired ratios between the quantities of the several materials are applied somewhat non-uniformly. The variances from uniformity will be different for each of the applications, thus adversely skewing the relative ratios of the materials with respect to each other at different locations in the e.g. field. Further, when applied separately to
20 the soil, the seed and the soil conditioner are not necessarily in intimate contact with each other as they are when both materials are combined into a single combined seed capsule product as in the invention. Nor is the seed in closely controlled proximity (e.g. within the same capsule) with the inorganic fertilizer. In
25 reality, then, any fertilizer added to the soil but not in close proximity to the seed applied to the same soil during e.g. the same growing season, is of reduced value or no value to that application of seed, whereby little or no value is realized, during that growing season, from the application of such material to the soil.

30 The amounts of soil conditioning material and inorganic fertilizer added to the soil at any given time represent a small fraction of the "soil" in the plant growing zone (root zone). Thus, in the conventional practice of providing separate

applications of plant nutrients and soil conditioning material, in addition to the seed, only small fractions of the newly applied soil conditioning material and plant nutrient come into proximate cooperating relationship with each other and with the seed. Thus, the seed and any plant newly emergent from the seed are benefitted only to the extent the overall average root zone of the soil is benefitted by the applied soil conditioning material

Even were combinations of soil conditioner, inorganic chemical fertilizer, and seed are to be applied as separate and distinct physical product particles, using a single application apparatus and a single application process, the individual particles of soil conditioner, individual particles of inorganic chemical fertilizer, and individual particles of seed would be separated from each other to a significant degree, during the application process, such that the benefits of intimate association with each other in the soil would be lost. Indeed, the seed benefits from intimate contact with a substantial quantity of soil conditioner, but can tolerate intimate contact with only limited concentrations of fertilizer chemicals. Rather, fertilizer chemicals should in general be displaced from, but controllably located close to the seed.

In an uncontrolled application of fertilizer by an application separate from application of the seed, as in the prior art, some of the seed might be expected to be placed so close to some of the inorganic fertilizer as to be damaged by the toxic affect of such close association. Thus, the benefit of intimate contact between organic soil conditioning material, inorganic chemical fertilizer, and seed, is reduced and largely lost because of low levels of intimate association between the soil conditioning material and the seed, and unpredictable, uncontrolled levels of association between the seed and the inorganic chemical fertilizer, outside the combination of the invention, of soil conditioning coating of the seed, and optional addition of inorganic fertilizer at controlled

location with respect to the seed, all in the same seed capsule, as taught herein.

By combining an organic soil conditioning material in the same seed capsule with the seed, highly effective levels of soil conditioner are assuredly associated with the seed as the seed germinates and begins to grow. Where suitable levels of plant nutrient fertilizer are incorporated into the same seed capsule, growth of the newly-germinated plant is further enhanced. In either case, the soil conditioning materials can and do tend to retain moisture and nutrients in the soil in the defined area of the seed capsule by a variety of mechanisms, providing an extended time period during which nutrients can be taken up by the plants. For example, organic soil conditioning material may retain moisture, reducing moisture drainage from the soil, such that the rate of leaching of the nutrients is, in general, reduced. Further, the soil conditioning material may absorb or otherwise physically or chemically attach to plant nutrient materials in the chemical fertilizer material, thus further retarding leaching of the plant nutrient away from the seed.

While applicant cannot place an exact time period on the increase in the extent to which the soil conditioning materials retard leaching of the plant nutrients from proximity with the seed, thereby holding the plant nutrients available for up-take by the plant, any increase in time during which the nutrients are held in the soil proximate the newly-emerging plant is beneficial to meeting the nutritional needs of the plant being so fed.

By incorporating soil conditioning materials and optionally plant nutrient fertilizers, in the seed capsules, the invention offers an efficiency of application of soil conditioning materials in proximity to the seeds most beneficially affected thereby, in a beneficial association never before available. Optional addition of plant nutrients to the same seed capsule provides a largely self-contained microcosm of seed, soil conditioner, and inorganic

fertilizer in intimate yet controlled spatial relationship with each other, whereby the controlled spacings provide enhanced plant growth benefit. Namely, soil conditioning materials and plant nutrients are somewhat beneficial to each other for the overall cooperative achievement of soil fertility in the presence of the newly emerging plant which is dependent on such plant nutrients, and on moisture retained by the soil conditioner for uptake of such plant nutrients.

While soil conditioning materials do perform a number of highly interdependent tasks, one such task is in assisting in maintaining the plant nutrients in the root zone where they can be effectively used by the plants when needed. Another such task is in assisting in making the soil soft and friable in the root zone whereby the newly-emerged and very tender plant roots more readily penetrate the soil as they grow.

Where both soil conditioner and fertilizer are incorporated with the seed into the seed capsule, the soil conditioner assists in strategically maintaining the combination of soil conditioner and plant nutrients in close and controlled proximity to each other and to the seed in the soil. Such strategic placement virtually assures that the soil conditioning material and inorganic chemical fertilizer are bound to each other, in proximate relationship with the seed, for a time, such that wherever the seed capsule may land when the seed is sown, the seed will have the initial benefit of both soil conditioner and plant nutrients in intimate proximity with itself, irrespective of any condition of the surrounding growth medium. Thus, in the invention, soil conditioning material and optionally inorganic chemical fertilizer, are inherently bound to each other, and to the seed, as by the coating process, and inherently assist the seed in achieving desired germination and strong early growth.

By incorporating the soil conditioning material in the same seed capsule with the seed, the invention ensures that the seed has

benefit of intimate relationship with a beneficial amount of soil conditioner material. The seed thus receives the advantage of the beneficial amount of soil conditioner material irrespective of the overall tilth of the soil and irrespective of the overall level
5 soil conditioner, e.g. soil texture conditioner, in the root zone of the soil with which the seed capsule becomes associated for seed and plant growth purposes.

Referring to FIGURE 7, a population of seed capsules **38** are disposed at the top surface of a cross section of soil. Root zone
10 **150** of the soil is generally defined to that depth of the soil which typically receives roots of growing plants, and is generally defined within 20-30 inches of the top surface of the soil. Generally, and preferably, the root zone should have a soft texture, rich in organic and/or other soil conditioning material in order to provide good tilth, and desirable moisture and nutrient holding properties. Underlying root zone **150** is subsoil **152** which typically contains little organic matter.

It is a well known agricultural phenomenon that, in soil used for intensive crop production, the root zone tends, over time, to become relatively depleted of organic soil conditioning material, illustrated at **154** in FIGURE 7, negatively affecting soil tilth and texture. While wholesale addition of organic soil conditioning material can improve the overall tilth of the soil, FIGURE 7
20 illustrates application of the invention wherein the texture of the material immediately adjacent the seed, namely coating **42**, provides beneficial properties attributable to soil having desirable texture.

FIGURE 8 illustrates that coating **42** draws moisture **154** from the soil, into the capsule, where the moisture is available to assist in germination of seed **40**. In the process, traverse of the
30 moisture through second coating **46C** releases plant nutrient material into the moisture, as well as downwardly into the soil adjacent the seed capsule, as illustrated at **156**. Thus, the root

158 emerging from the seed emerges into an initial growth medium, coating 42, having texture, moisture, and plant nutrient highly advantageous to early plant growth. As root 158 advances further downward, the upper portion of the underlying soil under the capsule where the seed first enters the soil, has also been beneficially affected to the good of the plant by plant nutrients 156, and by moisture attracted or held in the vicinity of the capsule, as a result of the presence of the soil conditioning material in the capsule.

The relative amounts of the soil conditioning material and the inorganic chemical fertilizer material in the seed capsule vary significantly in accord with the specific application, and any specific interactivity desired of the soil conditioning material and inorganic chemical fertilizer. For example, in a particular combination of soil conditioning material and inorganic fertilizer a particular plant crop to be nourished by the product may require a higher amount of plant nutrient, or a specific analysis of plant nutrients, in order to be properly fed at and shortly after the stage of germination.

Thus, for a given specific application of combination seed capsule (with fertilizer) product of the invention, the relative amount of inorganic chemical fertilizer, and the fertilizer analysis, may be increased or decreased from some "standard" in the interest of achieving a functionally adequate feeding of the newly germinated seedlings. Namely, the NPK etc. nutrient levels provided in a given seed capsule product of the invention can be set and controlled at the fertilizer manufacturing plant in accord with the respective NPK etc. nutrient needs of the seed to be supported, or of the soil or other growth medium to which the combination fertilizer of the invention is to be applied.

In any embodiments, whether or not specifically discussed here, the fabricated seed capsules are kept sufficiently cool, and are kept sufficiently dry, to avoid the seed capsules sticking to

each other, caking, and the like, and to prevent premature germination of the seed. Where liquid is used to obtain the coating material in liquid state, sufficient liquid is removed during or shortly after the coating step to avoid the seed capsules sticking to each other, or caking, or the like. Where the seed capsules are made by process other than the process described here, the details of the process will determine proper cooling, drying, or other steps to provide a finished, dry, solid seed capsule or like product. A dry such product generally has moisture content less than 10% by weight, preferably less than 5% by weight, most preferably less than 3% by weight.

As suggested by the description hereinabove, the processes of the invention are generally carried out to make combination seed improvement products solely by using physical processes such as coating and drying. While some minor chemical reactions may inadvertently accompany such physical processes, the invention does not rely on any chemical reaction for achievement of the objectives thereof. Rather the invention is focused on a physical combination of starting materials, which physical combination results in mutual benefits of the two starting materials (seed and soil conditioner, and optional inorganic chemical fertilizer) functioning intimately together, in primarily physical and physico-chemical relationship, to produce an overall increase in benefits of plant germination and early plant growth with such combination seed improvement products.

The relative amounts of seed and coating material depend on the overall benefits desired to be achieved from the coating operations. In general, the seed will comprise from about 0.1% to about 75% of the overall weight of the seed capsule. the coating material thus represents about 25% to about 99.9% by weight of the seed capsule. Where the seed content is low, the general benefit of the product is that of soil conditioning, with some seed application. Such product is well suited for application to e.g.

a healthy lawn for general improvement of soil condition, and modest fill-in of bare spots with seed.

Another benefit of low seed content by weight, especially with quite small seeds, is in creating a larger size seed capsule, and thereby facilitating the handling of such seed in commonly-used seed handling machines such as grain drills or seed broadcast machines.

Typically, however, a higher seed content is preferred so as to have major impact on the number of plants which are caused to germinate by application of such product. Thus, for a seed about 0.5-1.0 mm thick and about 4-7 mm long, a preferred fraction of seed is about 1% to about 50%, preferably about 1.5% to about 20%, more preferably about 2% to about 10% by weight seed, with respective amount of soil conditioner and optionally fertilizer. For example, in a preferred product of the invention, an above mentioned grass seed about 0.5-1.0 mm thick and about 4-7 mm long, when coated produces a seed capsule about 4 mm across and about 6-9 mm long. Smaller, or larger, seed capsules may be made and used as desired.

The size and density of the seed capsules can be readily controlled using conventional sizing equipment and processing parameters of the coating process, so as to provide a uniform product of a wide range of sizes and densities. With the size and density of any seed thus controllable, the size and density may be selected and specified for enhancing control and efficiency of seed handling and/or distribution. For example, tiny seeds such as lettuce, carrots, cabbage, and alfalfa, may be sized and weighted for easy and assured handling and distribution, whether by hand or by machine. Seeds which are non-aerodynamic, or which are so light as to be blown around, such as grass seed, can be made heavy and compact enough as to assuredly remain on location where sown after being planted. For example, non-aerodynamic seeds, after treatment according to the invention, can be broadcast-applied using

conventional equipment such as is used to broadcast apply granular fertilizer over e.g. 40 foot wide application paths.

5 Where time controlled germination is desirable, a population of combination seed capsules, having at least one soil conditioner and one or more nutrients, can be planted in conjunction with non-coated seeds. As a result, non-coated seeds will germinate at an earlier stage than the population of combination seed capsules. Such staggering of germination times allows, for example, the non-coated seeds to use the available soil nutrients with less
10 competition (i.e. less seeds using limited nutrient supply). At a later time, when the coated seeds germinate, such seeds can use the nutrients leached from their combination seed capsules to germinate.

15 Where e.g. small such seeds are desirably planted in close proximity with each other, and wherein a relatively larger size seed capsule is desired for ease of handling such that the large size seed capsule would potentially interfere with such close placement of the seeds with respect to each other, then and in such situation, multiple seeds may be employed in individual seed
20 capsules, e.g. generally uniformly distributed throughout the seed capsule, so as to provide for sufficiently close spacing of the seeds from each other.

25 Paper mill sludge, as is suggested as a coating material herein, is a resultant by-product of papermaking, typically from e.g. a de-inking process in the paper mill.

By utilizing paper mill sludge and/or sewage sludge as taught herein, one contemplates beneficially and suitably disposing of significant quantities of industrial waste which otherwise is disposed of by landfilling.

30 Where the product of the invention is applied as to a residential or like lawn, as in an agricultural field, the seed is applied to the soil in intimate combination (seed capsule) with the soil conditioner, such that the soil conditioner serves as moisture

retainer and sun shield. In addition, the seed capsule is much heavier and dense than the seed itself, whereby the seed capsule provides substantial protection against the seed being washed away in surface water run-off. Thus, the coating about the seed serves many of the functions typically performed by the conventionally-used straw mulch. Accordingly, product of the invention can be used to seed new lawns without any need for use of straw or any other mulch material.

Where seed is desirably used to fill in bare spots in the lawn, such seed, especially fertility-enhanced seed capsules, may be applied desirably in one of two ways. First, the coated seed capsule product may be applied only to perceived bare spots, without use of straw. The soil conditioner in the seed capsules serve the functions of the straw as described above, but perform better than straw because of the close association between the seed and the soil conditioner.

In the alternative, the coated seed capsule product may be broadcast generally over the entire lawn. Where the lawn is already healthy with thick grass growth, the soil conditioner and fertilizer will benefit the existing grasses, with minimal germination and growth of new seed from the seed capsules. Where the existing grass is thinner, the seeds in the seed capsules will have room and light to grow, whereby the combined properties of seed, soil conditioner, and fertilizer, in intimate relationship with one another, will be efficaciously used.

Where seed capsules of the invention are used to establish a new lawn, the soil conditioner in the seed capsules serve the functions of the straw as described above, obviating the need for straw in establishing the lawn seeding.

Those skilled in the art will now see that certain modifications can be made to the apparatus and methods herein disclosed with respect to the illustrated embodiments, without departing from the spirit of the instant invention. And while the

invention has been described above with respect to the preferred embodiments, it will be understood that the invention is adapted to numerous rearrangements, modifications, and alterations

To the extent the following claims use means plus function
5 language, it is not meant to include there, or in the instant specification, anything not structurally equivalent to what is shown in the embodiments disclosed in the specification.

SECRET

CLAIMS

Having thus described the invention, what is claimed is:

1. A combination seed capsule, comprising:

- (a) at least one viable seed, having an outer surface and acting as a core or psuedo-core of said combination seed capsule; and
- (b) a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed.

2. A combination seed capsule as in Claim 1, said coating providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;
- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;

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- (v) enhancing control of moisture about said seed thereby to assist in seed germination;
- (vi) release of plant nutrients into soil onto which said combination seed capsule is placed;
- (vii) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released;
- (ix) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density; and
- (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

3. A combination seed capsule as in Claim 1 wherein said seed is selected from the group consisting of grass, vegetables, grains, and flowers.

4. A combination seed capsule as in Claim 1, said coating further comprising said soil conditioning material in combination with at least one ingredient effective to reduce susceptibility of

said seed capsule to deleterious affect of at least one of animals, weeds, and spore-formers.

5. A combination seed capsule as in Claim 4 wherein said at least one ingredient to reduce susceptibility of the seed capsule is selected from the group consisting of herbicides, fungicides, and a bitter substance.

6. A combination seed capsule as in Claim 5 wherein said fungicide comprises metalaxyl.

7. A combination seed capsule as in Claim 1, said coating comprising a first coating, said combination seed capsule further comprising a second coating, separate from said first coating, and comprising at least one ingredient effective to reduce susceptibility of said seed capsule to deleterious effect of at least one of animals, weeds, and spore-formers.

8. A combination seed capsule as in Claim 1, effective to provide a plant nutrient at a desirable controlled distance from a plant seedling emerging from said seed, in an amount beneficial to said plant seedling.

9. A combination seed capsule as in Claim 1, said coating comprising a first coating, said combination seed capsule further comprising a second coating of a second coating material intermingled with said first coating material in an outer portion of said first coating, and generally displaced from said seed.

10. A combination seed capsule as in Claim 9 wherein said second coating material comprises a plant nutrient, beneficial in location and in amount of availability, to plant seedling emerging from said seed.

11. A combination seed capsule as in Claim 9 wherein said second coating composition comprises an inorganic form of a plant nutrient and is selected from the group consisting of nitrogen, phosphorus, and potassium.

12. A combination seed capsule as in Claim 9 wherein said second coating composition comprises an inorganic form of a plant nutrient and is selected from the group consisting of urea, monammonium phosphate, diammonium phosphate, superphosphate, triple superphosphate, dicalcium phosphate, and potash.

13. A combination seed capsule as in Claim 9 wherein said second coating composition comprises an inorganic form of a plant nutrient is selected from the group consisting of sulfur, manganese, copper, boron, iron, magnesium and chromium.

14. A population of combination seed capsules of Claim 1, said population of seed capsules comprising coatings having a range of properties affecting germination rate of said seeds, thereby to stage germination of said seeds in said population over a period of time longer than the range of germination times inherent in uncoated ones of said seeds.

15. A population of combination seed capsules as in Claim 14 wherein said range of properties comprises at least one of (i) a range of hardnesses and (ii) a range of thicknesses, of said coatings.

16. A combination seed capsule as in Claim 1, said coating comprising a first layer of said soil conditioning material, and including a second layer comprising an inorganic fertilizer.

17. A combination seed capsule as in Claim 1, said coating comprising a first layer of said soil conditioning material, and including a second layer comprising at least one micronutrient.

18. A combination seed capsule as in Claim 17 wherein said micronutrient is selected from the group consisting of sulfur, manganese, copper, boron, iron, magnesium and chromium.

19. A combination seed capsule as in Claim 1, said soil conditioning material comprising a sludge composition.

20. A combination seed capsule as in Claim 1, said soil conditioning material comprising a fiber-containing by-product of a paper making operation.

21. A combination seed capsule as in Claim 1, said seed capsule comprising a water-leachable plant nutrient, and a leach-

retardant composition effective to retard leaching of said leachable plant nutrient out of said combination seed capsule.

22. A population of combination seed capsules of Claim 1, said coating in ones, but less than all, of said population, comprising an ingredient effective to retard effective penetration of a seed-germinating environment to said seed for germination thereof.

23. A combination seed capsule as in Claim 1, said seed capsule comprising an inner layer on the outer surface of said seed, and an outer layer, said inner layer enhancing properties of said seed for acting as nucleus in an agglomeration operation agglomerating said coating onto said inner layer.

24. A combination seed capsule as in Claim 1 wherein said coating comprises an admixture of said soil conditioner and a plant nutrient.

25. A combination seed capsule as in Claim 1 wherein said coating remains generally disposed about said seed until said seed germinates.

26. A plant growing system, comprising:

- (a) a plant growing medium extending over an area, said plant growing medium having a root zone, and a top surface of said root zone generally corresponding with a top surface

of said plant growing medium, said plant growing medium having a first overall soil condition and texture; and

- (b) a population of seed capsules disposed over the top surface of said plant growing medium, said seed capsules comprising individual seeds, having outer surfaces, and coatings of soil conditioning material disposed outwardly of the outer surfaces of said seeds,

said coatings of said seed capsules providing localized germination and growth environments, at and adjacent said seeds, having texture, and nutrient and water holding properties for supporting seedling health, superior to respective said properties as provided overall in the root zone of said plant growing medium.

27. A growing system as in Claim 26, said coatings remaining generally disposed about said seeds until respective ones of said seeds germinate.

28. A growing system as in Claim 26, said coatings providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;

- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;
- (v) enhancing control of moisture about said seed thereby to assist in seed germination;
- (vi) release of plant nutrients into soil onto which said combination seed capsule is placed;
- (vii) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released;
- (ix) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density; and
- (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

29. A growing system as in Claim 26 wherein said seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

30. A growing system as in Claim 26, said coatings further comprising said soil conditioning material in combination with at least one ingredient effective to reduce susceptibility of said seed capsules to deleterious affect of at least one of animals, weeds, and spore-formers.

31. A growing system as in Claim 26, said coating comprising a first coating, said combination seed capsules further comprising a second coating, separate from said first coating, and comprising at least one ingredient effective to reduce susceptibility of said seed capsules to deleterious effect of at least one of animals, weeds, and spore-formers.

32. A growing system as in Claim 26, effective to provide plant nutrients at desirable controlled distances from plant seedlings emerging from said seeds, in amounts beneficial to said plant seedlings.

33. A growing system as in Claim 26, said coatings comprising first coatings, said combination seed capsules further comprising second coatings of second coating materials intermingled with said first coating materials in outer portions of said first coatings, and generally displaced from said seeds.

34. A growing system as in Claim 33 wherein said second coating materials comprise plant nutrients, beneficial in location and in amount of availability, to plant seedlings emerging from said seeds.

35. A growing system as in Claim 26, said population of seed capsules comprising coatings having a range of properties affecting germination rates of said seeds, thereby to stage germination of said seeds in said population over a period of time longer than the range of germination times inherent in uncoated ones of said seeds.

36. A growing system as in Claim 26, said coatings comprising first layers of said soil conditioning material, and including second layers comprising inorganic fertilizer.

37. A growing system as in Claim 26, said soil conditioning material comprising a sludge composition.

38. A growing system as in Claim 26, said soil conditioning material comprising a fiber-containing by-product of a paper making operation.

39. A growing system as in Claim 26, said seed capsules comprising inner layers on the outer surfaces of said seeds, said inner layers enhancing properties of said seeds for acting as nucleus in an agglomeration operation agglomerating said coatings onto said inner layers.

40. A growing system as in Claim 26 wherein said coatings comprise admixtures of said soil conditioner and plant nutrient.

41. A method of providing plant micronutrients to soil, the method comprising placing onto the soil a population of combination seed capsules, each comprising at least one seed, and a coating comprising a plant micronutrient material.

42. A method as in Claim 41, the coating comprising a first coating comprising the plant micronutrient, and a second coating, separate and distinct from the first coating, and comprising a soil conditioning material.

43. A method as in Claim 41, the coating providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;
- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;
- (v) enhancing control of moisture about said seed thereby to assist in seed germination;
- (vi) release of plant nutrients into soil onto which said combination seed capsule is placed;

- (vii) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released;
- (ix) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density; and
- (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

44. A method as in Claim 41, the coating providing a plant nutrient at a desirable controlled distance from a plant seedling emerging from the seed, in an amount beneficial to the plant seedling.

45. A method as in Claim 41, the coating comprising a first coating, the combination seed capsule further comprising a second coating of a second coating material intermingled with the first coating material in an outer portion of the first coating, and generally displaced from the seed.

46. A method as in Claim 45 wherein the first coating comprises plant micronutrient material and the second coating

comprises plant nutrient material comprising at least one of nitrogen, phosphorus, and potassium.

47. A method as in Claim 41 wherein the micronutrient composition comprises a plant nutrient selected from the group consisting of sulfur, manganese, copper, boron, iron, magnesium and chromium.

48. A method as in Claim 41, the coating comprising a first layer of the soil conditioning material, and including a second layer comprising an inorganic fertilizer.

49. A method as in Claim 41, the coating comprising a sludge composition.

50. A method as in Claim 41, the coating comprising a fiber-containing by-product of a paper making operation.

51. A method as in Claim 41, the seed capsule comprising an inner layer on an outer surface of the seed, and an outer layer, the inner layer enhancing properties of the seed for acting as nucleus in an agglomeration operation agglomerating the coating onto the inner layer.

52. A method as in Claim 41 wherein the coating comprising an admixture of soil conditioner and a plant nutrient.

53. A method as in Claim 41 wherein the coating remains generally disposed about the seed until the seed germinates.

54. A method of providing a seed bed having enhanced growing conditions for growing seed, the method comprising:

- (a) coating a population of the seeds with material, and thereby providing coatings thereon of such material, tending to stabilize, in the seed capsules, or in soil on which the seed capsules are disposed coating compositions which tend to hold, moisture adjacent the seeds in the seed capsules or in soil adjacent the seed capsules, in such quantities and for such times as to enhance growing conditions for the seeds; and
- (b) placing the population of seeds on soil effective to support germination of the seeds which are in the seed capsules.

55. A method as in Claim 54, the coatings providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;

- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;
- (v) release of plant nutrients into soil onto which said combination seed capsule is placed;
- (vi) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (vii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released; and
- (viii) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density.

56. A method as in Claim 54 wherein the seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

57. A method as in Claim 54, effective to provide a plant nutrient at desirable controlled distances from plant seedlings emerging from the seeds, in amounts beneficial to the plant seedlings.

58. A method as in Claim 54, the coatings comprising first coatings, the combination seed capsules further comprising second coatings of second coating materials intermingled with the first coating materials in outer portions of the first coatings, and generally displaced from the seeds.

59. A method as in Claim 58 wherein the second coating materials comprise plant nutrients, beneficial in location and in amount of availability, to plant seedlings emerging from the seeds.

60. A method as in Claim 58 wherein the second coating compositions comprise inorganic forms of plant nutrients and are selected from the group consisting of nitrogen, phosphorus, and potassium.

61. A method as in Claim 54, the population of seed capsules comprising coatings having a range of properties affecting germination rate of the seeds, thereby to stage germination of the seeds in the population over a period of time longer than the range of germination times inherent in uncoated ones of the seeds.

62. A method as in Claim 54, the coatings comprising first layers of the soil conditioning material, and including second layers comprising inorganic fertilizer.

63. A method as in Claim 54, the coatings comprising first layers of the soil conditioning materials, and including second layers comprising micronutrients.

64. A method as in Claim 54, the soil conditioning materials comprising sludge compositions.

65. A method as in Claim 54, the soil conditioning materials comprising fiber-containing by-products of paper making.

66. A method as in Claim 54, the seed capsules comprising water-leachable plant nutrients, and leach-retardant compositions effective to retard leaching of the leachable plant nutrients out of the combination seed capsules.

67. A method as in Claim 54, the seed capsules comprising inner layers on the outer surfaces of the seeds, and outer layers, the inner layers enhancing properties of the seeds for acting as nuclei in agglomeration operations agglomerating the coatings onto the inner layers.

68. A method as in Claim 54 wherein the coatings comprise admixtures of the soil conditioners and plant nutrients.

69. A method as in Claim 54 wherein the coatings remain generally disposed about the seeds until the seeds germinate.

70. A method of making a population of combination seed capsules, each comprising a seed, and a coating of a soil conditioning material, the method comprising:

- (a) pre-coating the seed with a material which enhances the ability of the seed to act as a nucleus in an agglomeration operation, to form a pre-coated substrate; and
- (b) subsequently coating the pre-coated substrate with a soil conditioning material.

71. A method as in Claim 70 wherein the pre-coating material comprises dicalcium phosphate.

72. A method as in Claim 70 wherein the pre-coating step results in an overall increase in the density of pre-coated seed combination.

73. A method as in Claim 70 wherein the pre-coating is accomplished by spraying the pre-coating material onto the seed.

74. A method of providing an enhanced seed germination environment in combination with placement of a controlled amount of plant nutrients in controlled proximity to each seed, the method comprising:

- (a) providing a population of seeds, coated with a soil conditioning material which tends to enhance germination of the seeds, and with plant nutrient composition effective to enhance growth of plant embryos emerging from the seeds; and

- (b) placing the population of seeds on soil effective to support germination of the seeds.

75. A method as in Claim 74 wherein the coating material includes therein a second ingredient comprising plant nutrient moieties.

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ABSTRACT OF THE DISCLOSURE

This invention pertains to combination seed capsules wherein each seed capsule includes both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent. The combination seed capsules are made by physically combining the respective soil conditioner and seed with one other, in the absence of any requirement for chemical reactions in the process of so combining the respective materials. The combination seed capsules provide cooperative and beneficial effects of the soil conditioner and the optional inorganic fertilizer, working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed, and optionally inorganic chemical fertilizer, are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the combination seed capsule, whereby the respective materials cooperate with each other in support of germination and plant growth.

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Applicant(s): Daniel Paul Madigan et al

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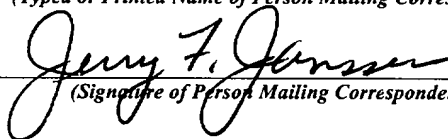
Invention: SEEDING TREATMENTS

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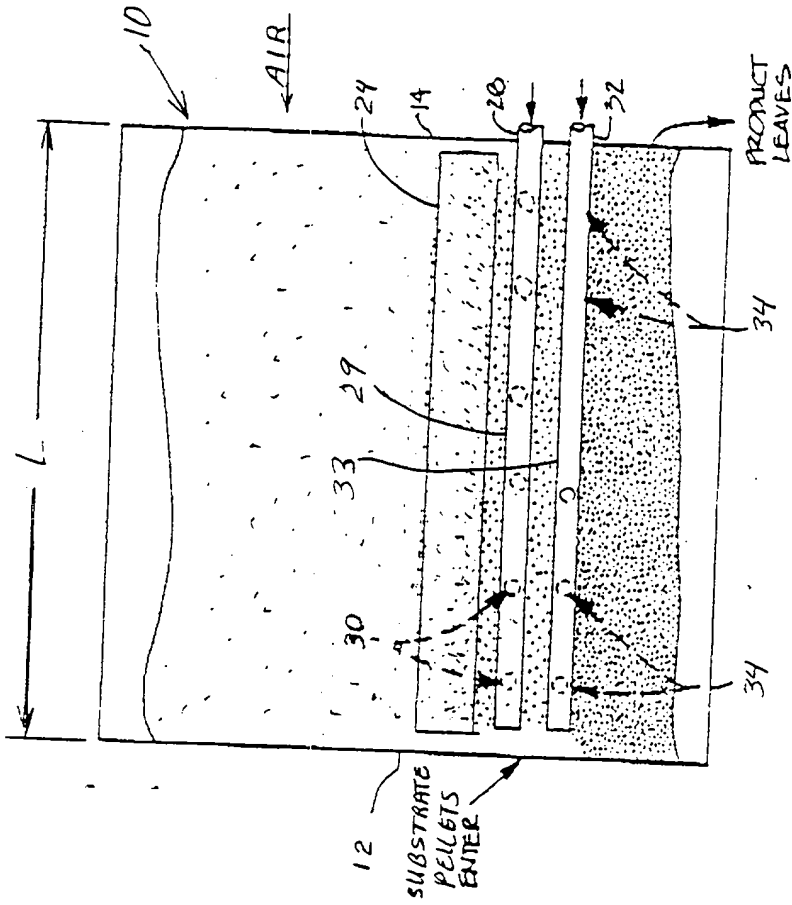


Fig. 2

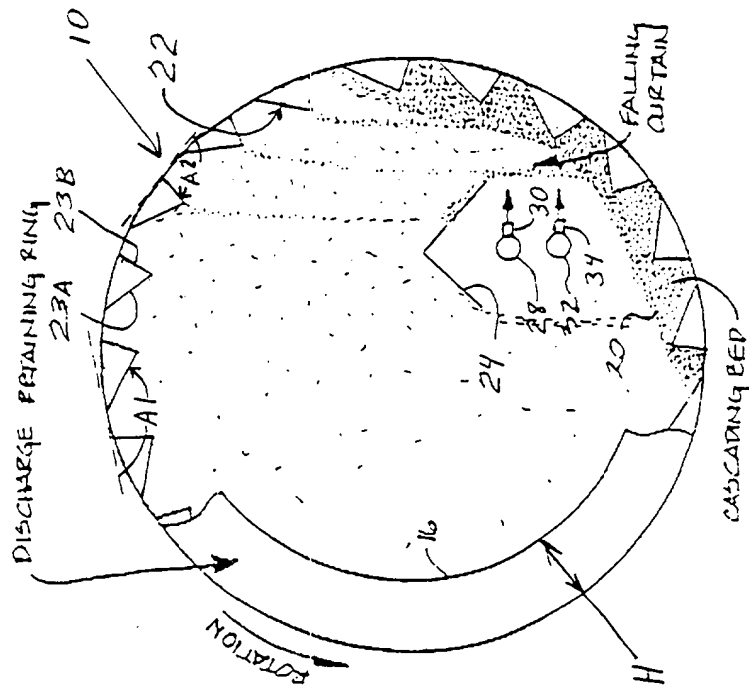


Fig. 1

Seed/Paper Sludge Agglomeration Process

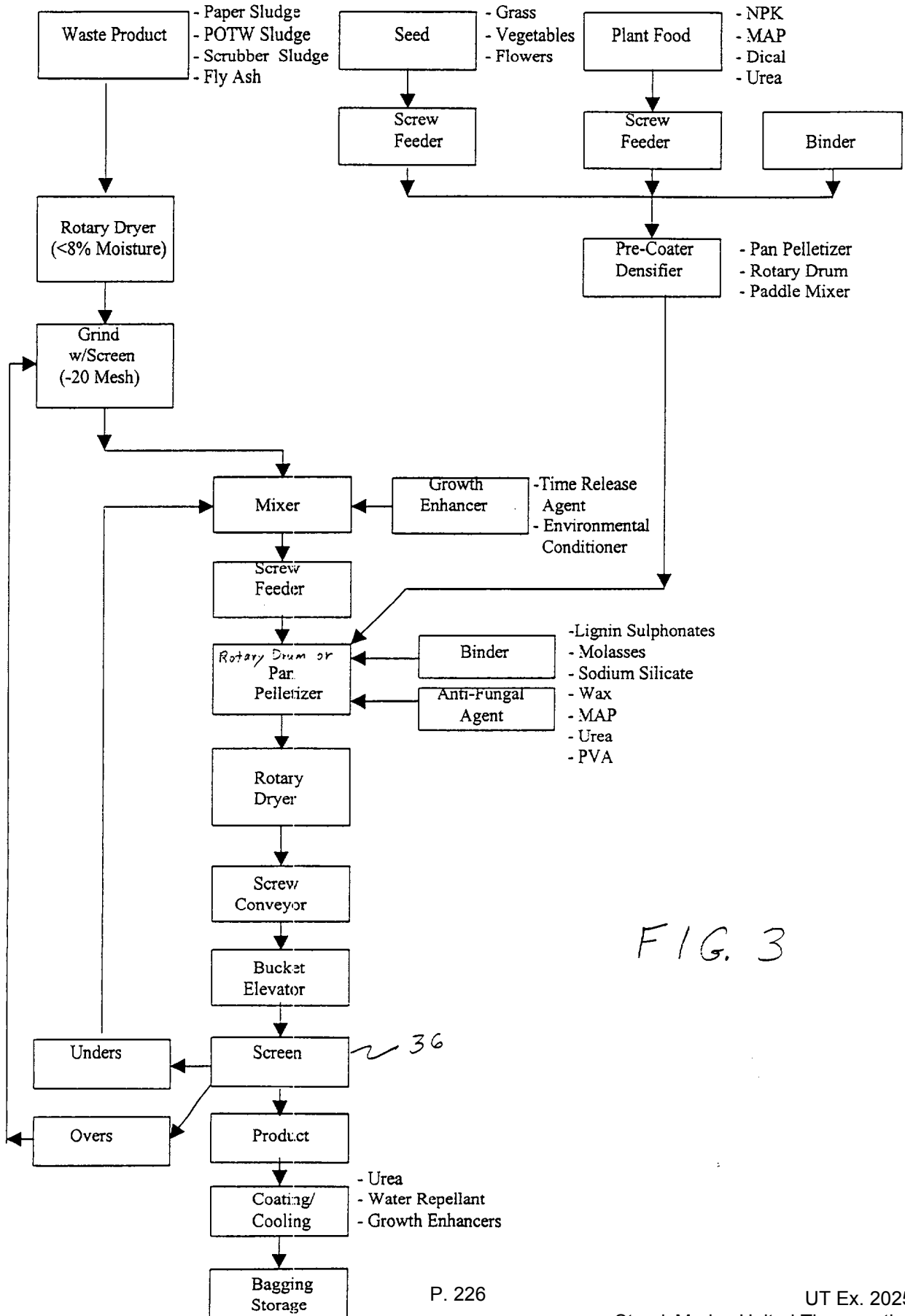


FIG. 3

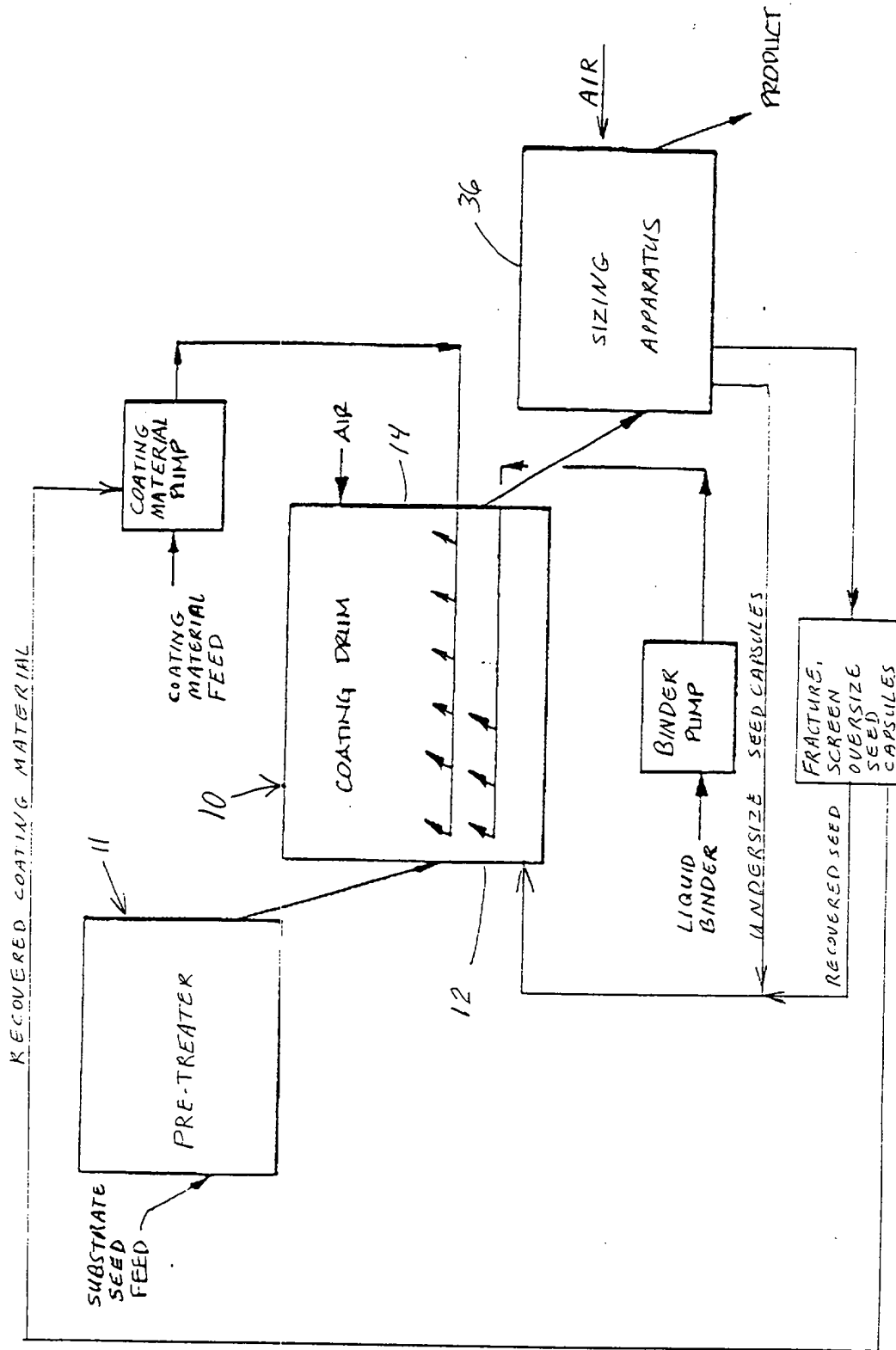


FIG. 4

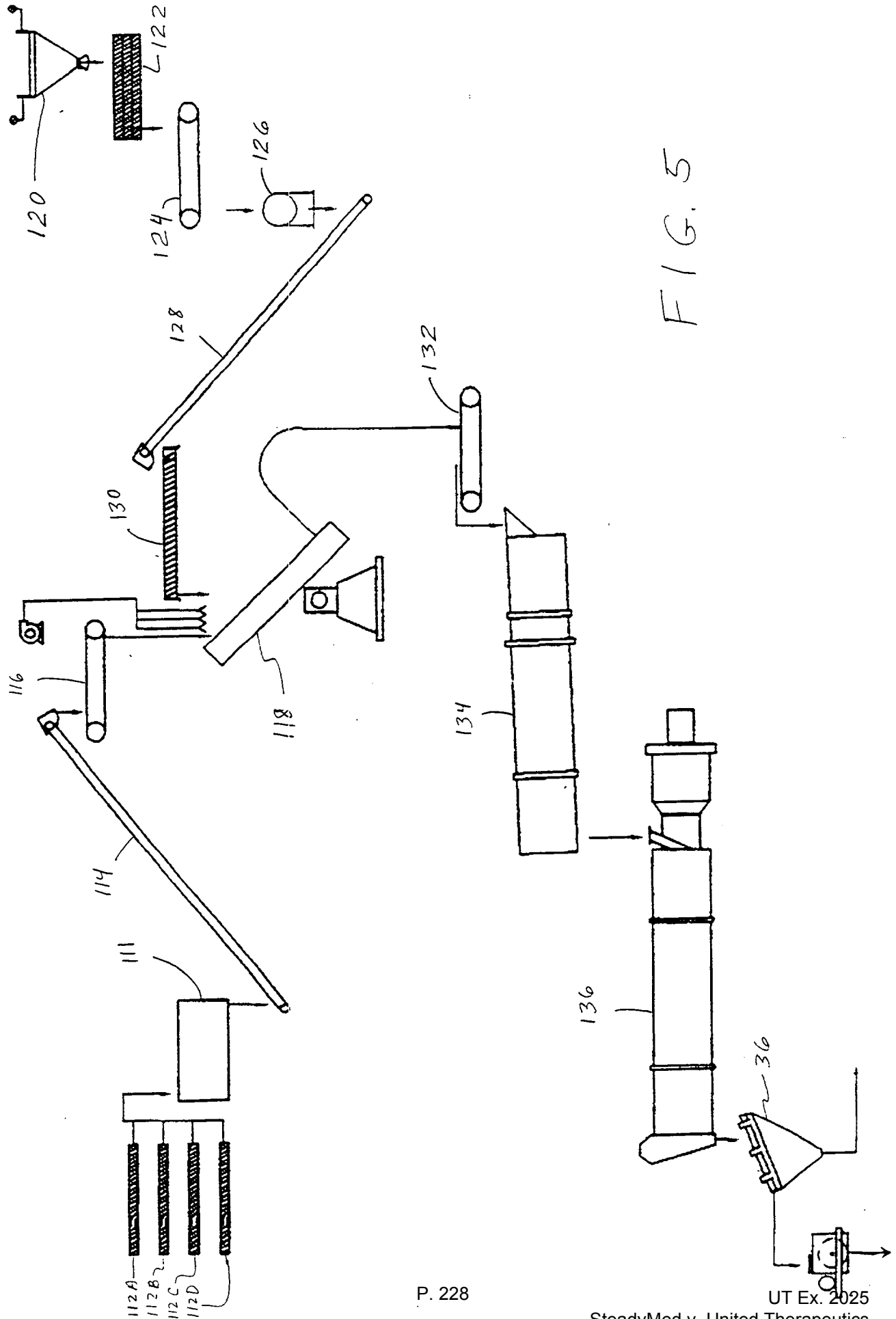


FIG. 5

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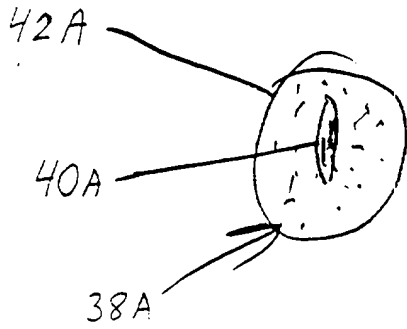


FIG. 6A

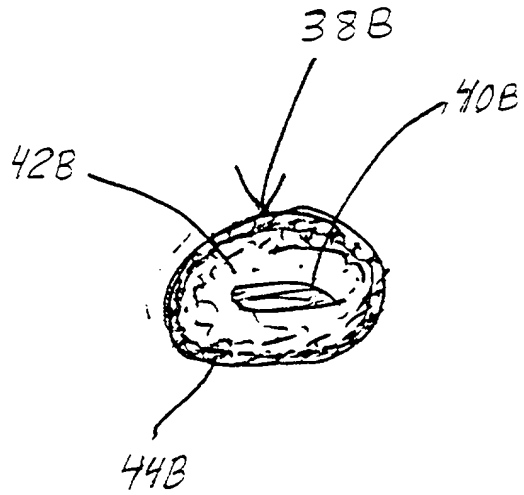


FIG. 6B

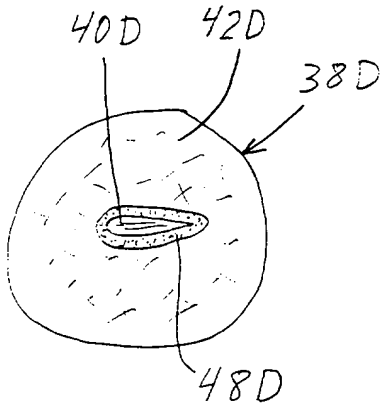


FIG. 6D

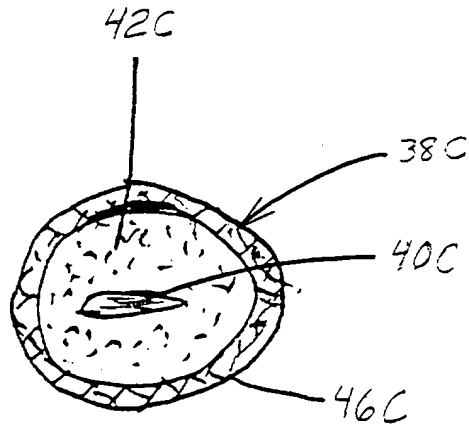


FIG. 6C

FIG. 7

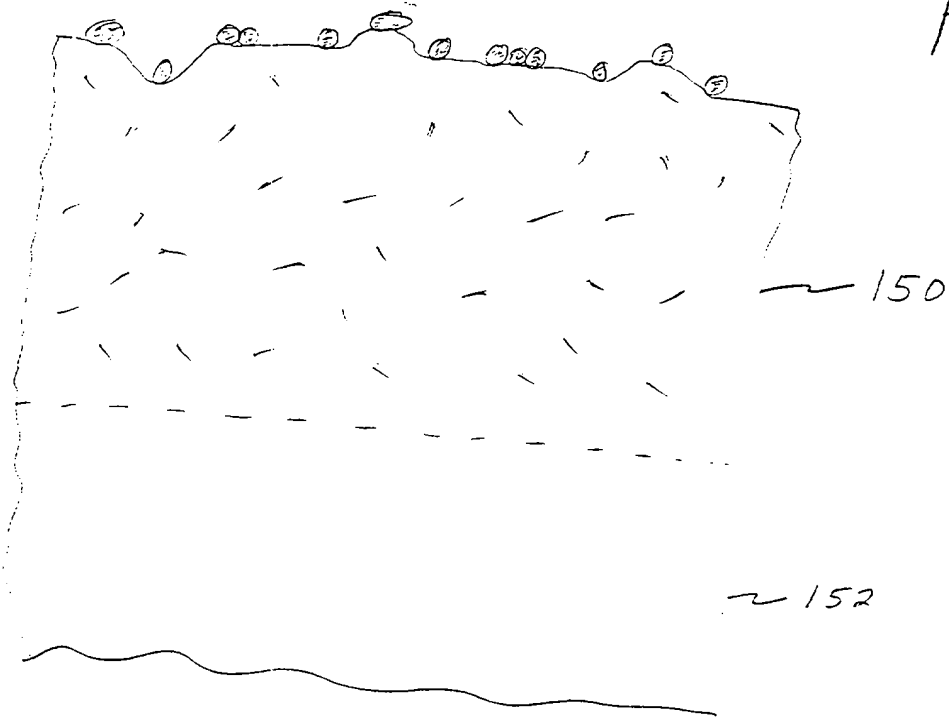
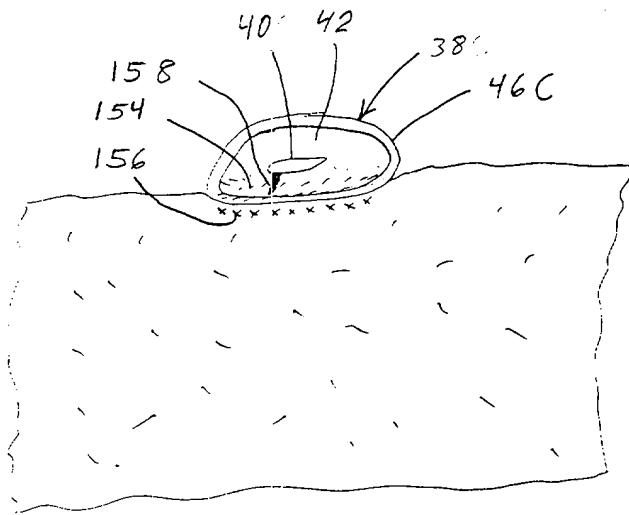
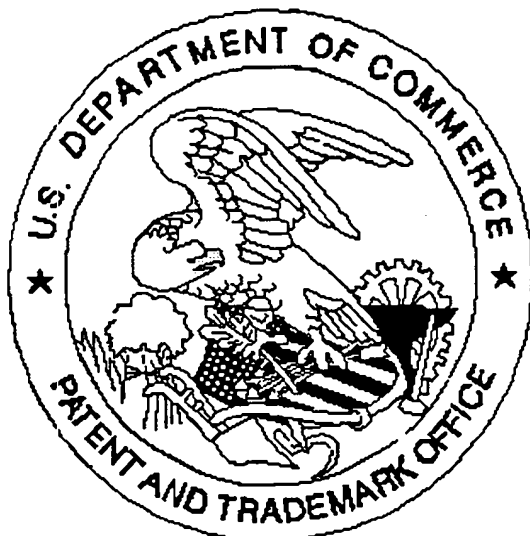


FIG. 8



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Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

SEEDING TREATMENTS

and invented by:

**DANIEL PAUL MADIGAN
MICHAEL DENNIS KRYSIAK
RONALD DEAN EICHHORN
GLEN H. WESENBERG**

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Application Elements

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 - b. Cross References to Related Applications (if applicable)
 - c. Statement Regarding Federally-sponsored Research/Development (if applicable)
 - d. Reference to Microfiche Appendix (if applicable)
 - e. Background of the Invention
 - f. Brief Summary of the Invention
 - g. Brief Description of the Drawings (if drawings filed)
 - h. Detailed Description
 - i. Claim(s) as Classified Below
 - j. Abstract of the Disclosure

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c. With Power of Attorney Without Power of Attorney
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5. Incorporation By Reference *(usable if Box 4b is checked)*
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incorporated by reference therein.
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10. English Translation Document *(if applicable)*
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15. Certified Copy of Priority Document(s) (if foreign priority is claimed)
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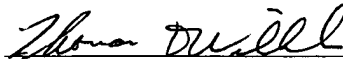
Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	75	- 20 =	55	x	\$11.00	\$605.00
Indep. Claims	5	- 3 =	2	x	\$41.00	\$82.00
Multiple Dependent Claims (check if applicable) <input type="checkbox"/>						\$0.00
BASIC FEE						\$395.00
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Signature

Thomas D. Wilhelm (Reg. No. 28,794)

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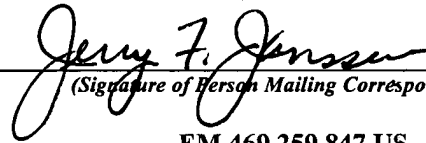
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Invention: SEEDING TREATMENTS

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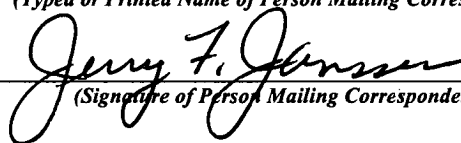
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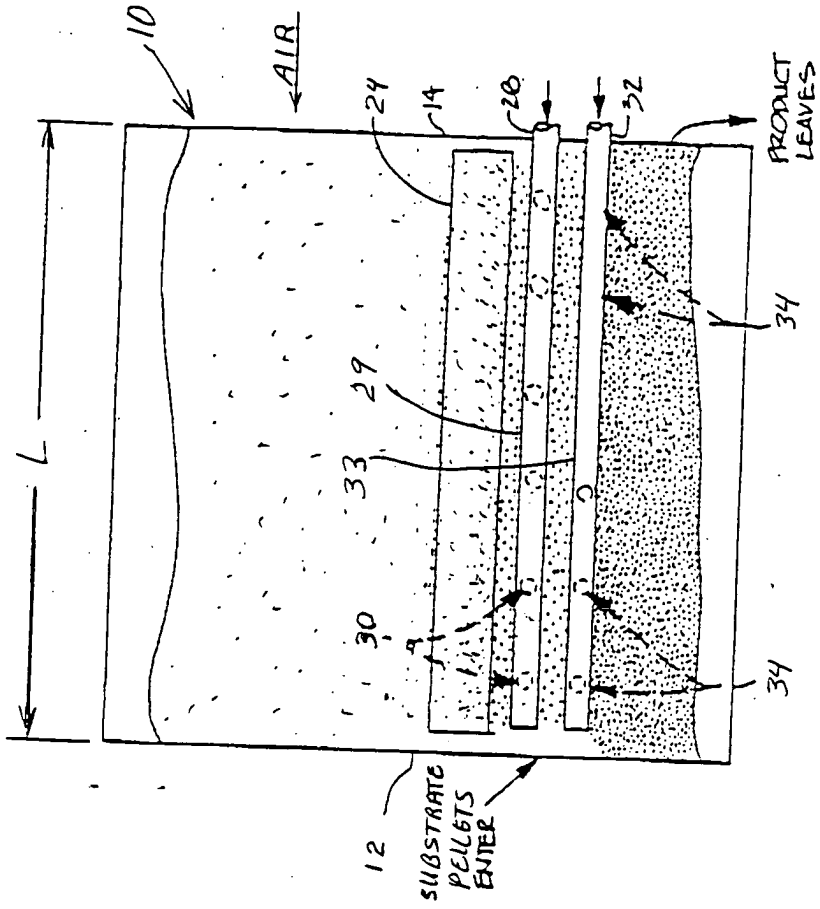


Fig. 2

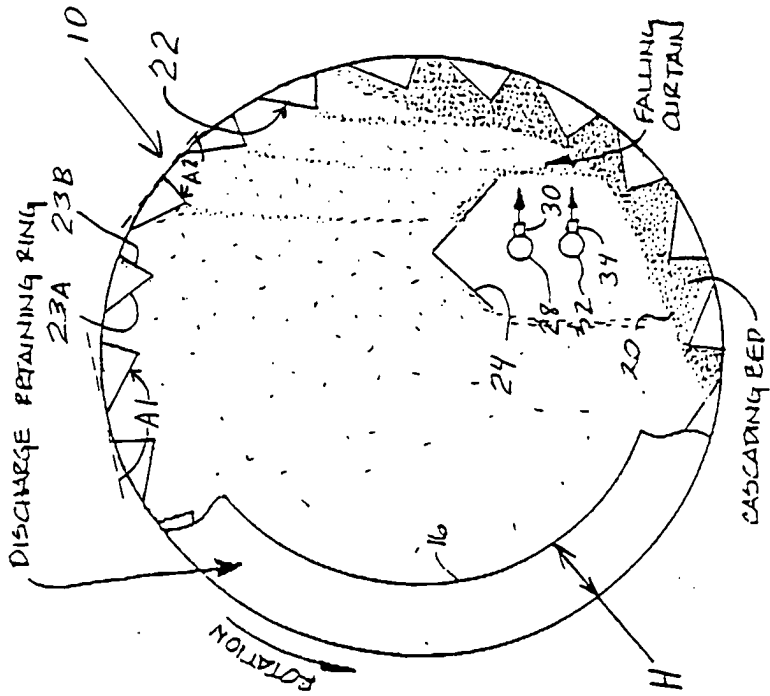


Fig. 1

Seed/Paper Sludge Agglomeration Process

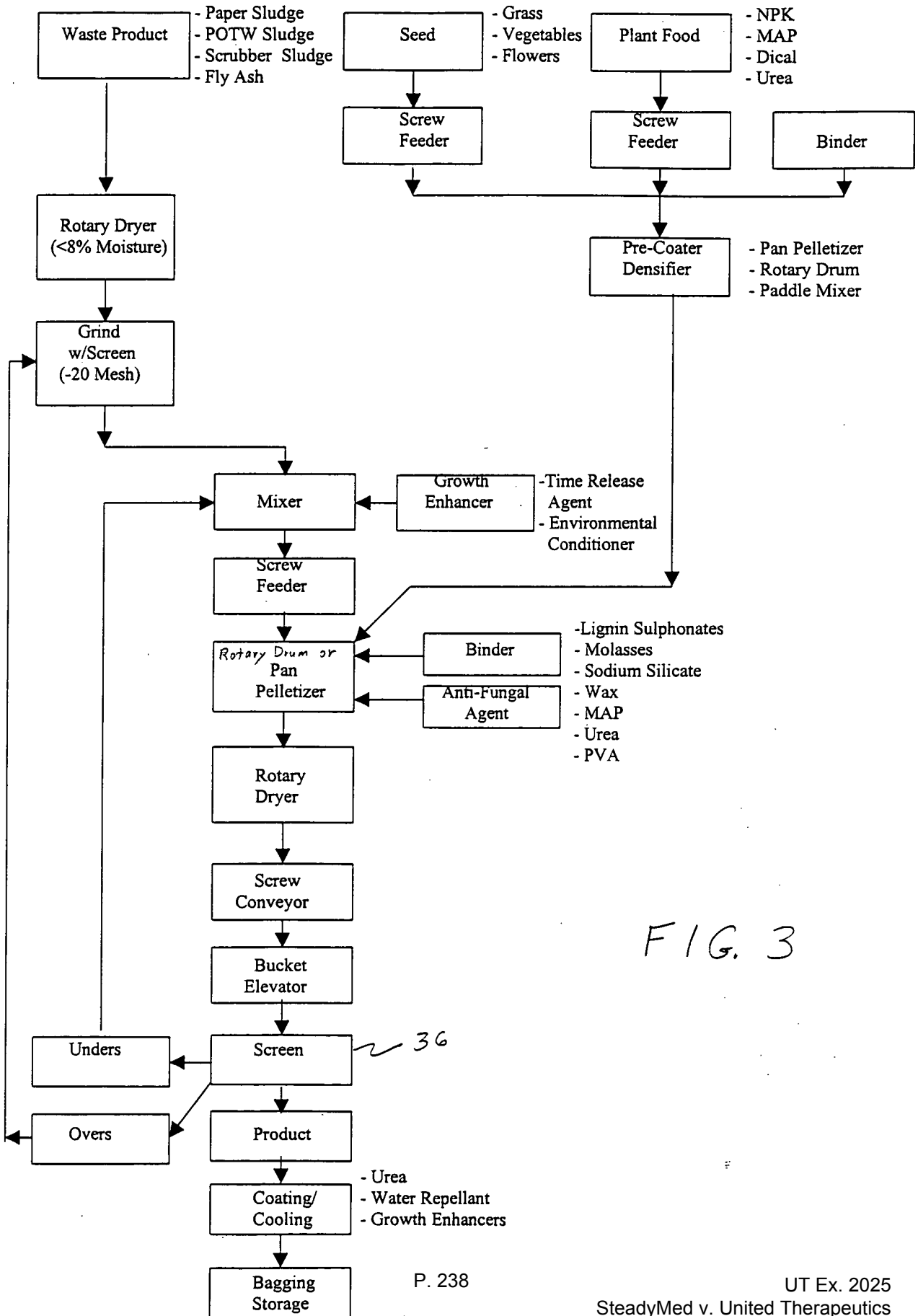


FIG. 3

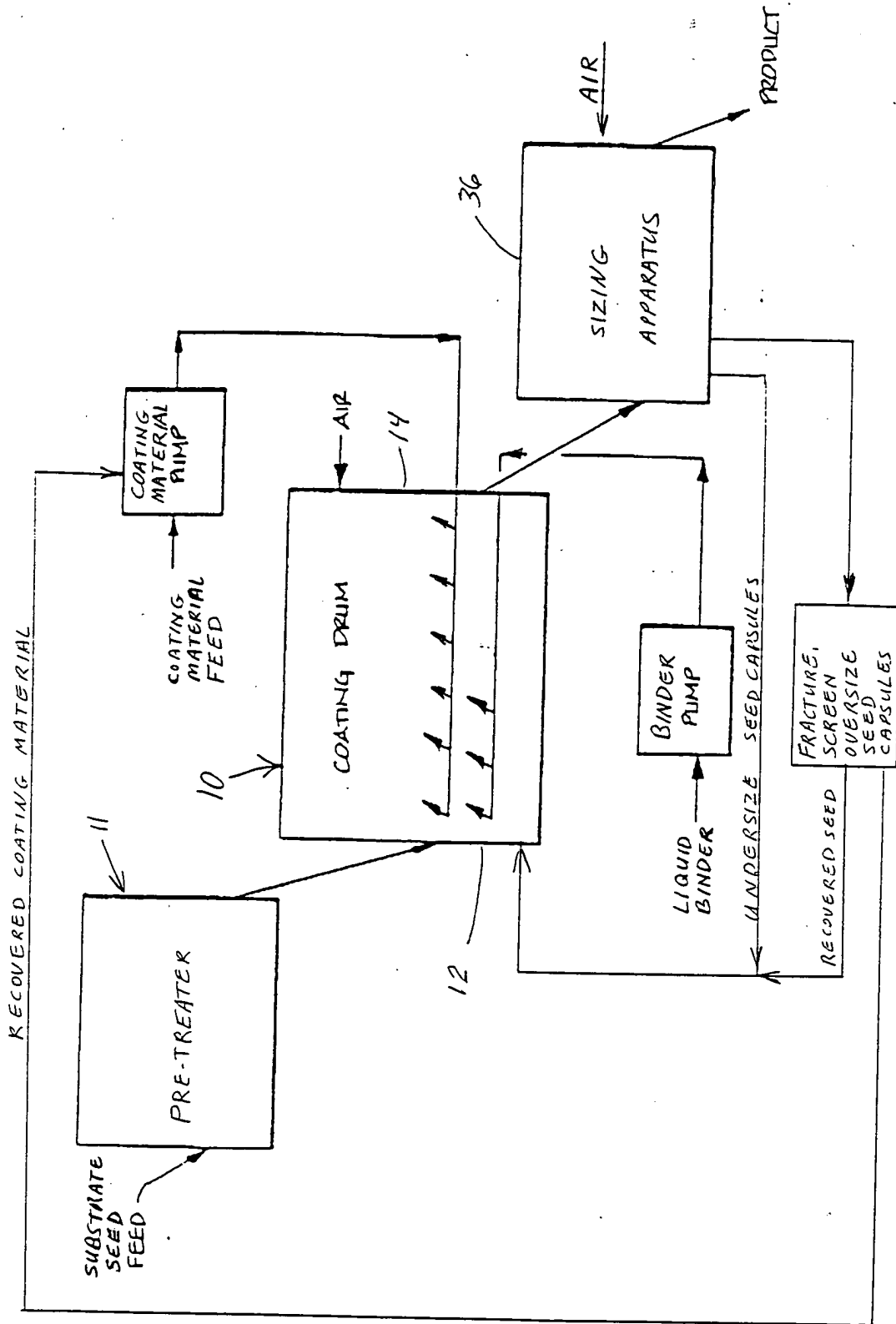
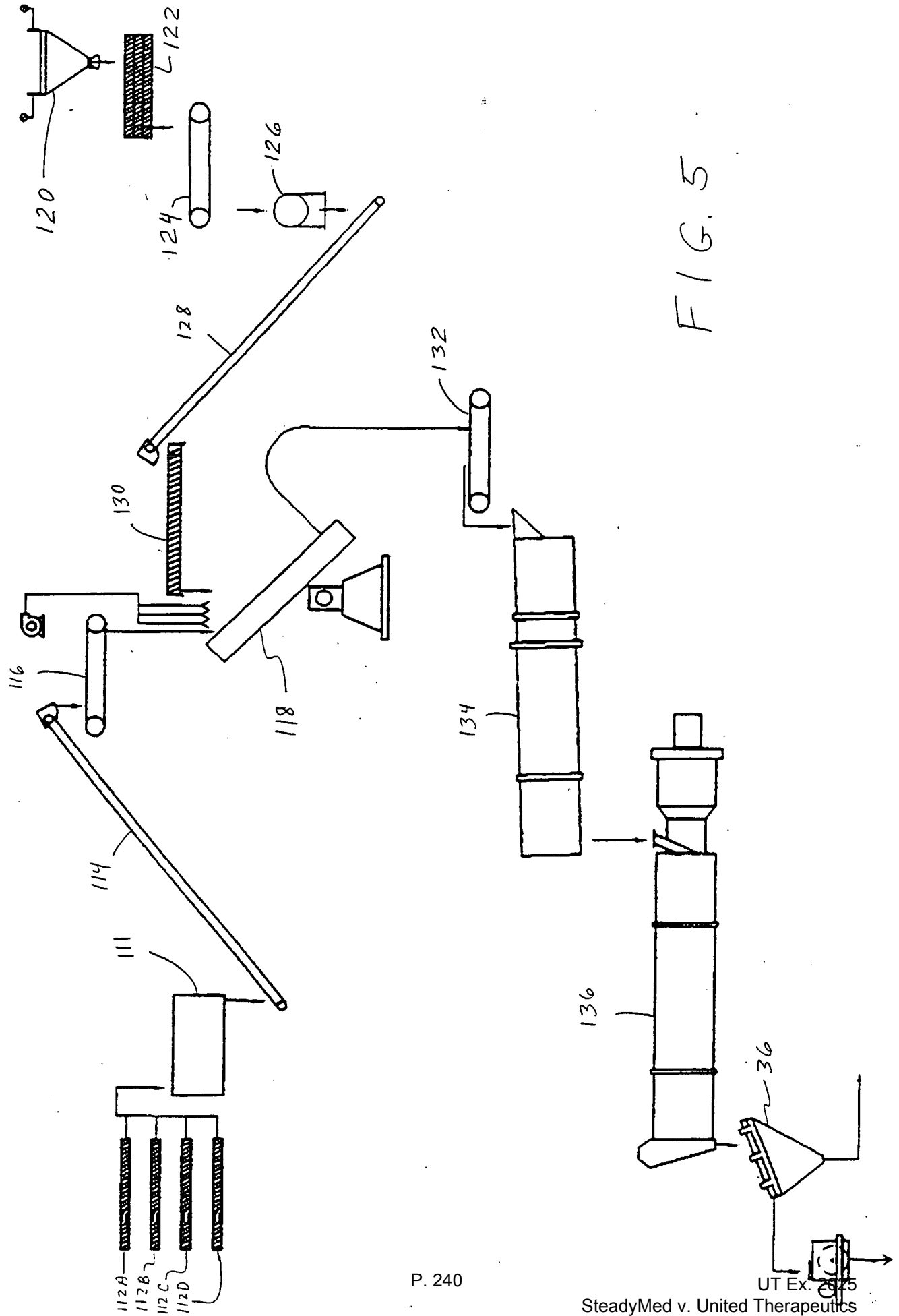


FIG. 4



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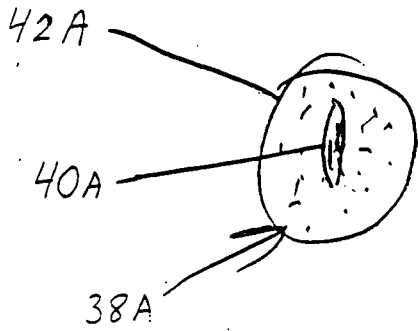


FIG. 6A

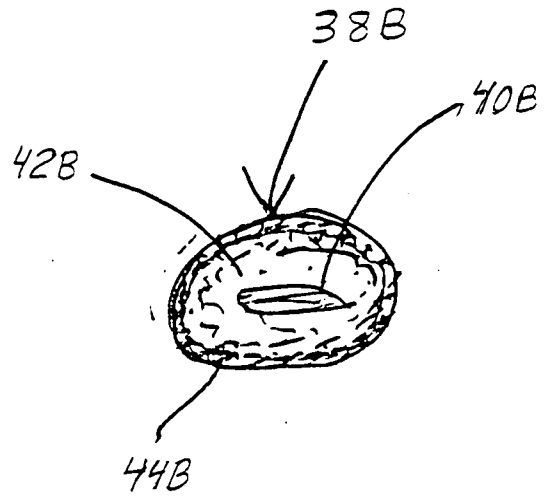


FIG. 6B

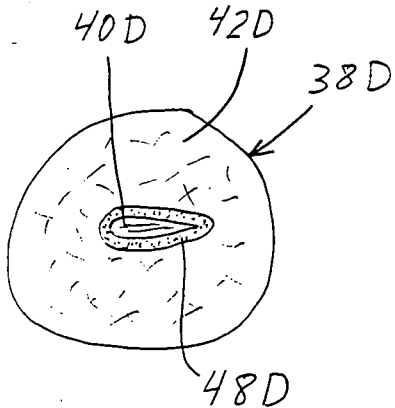


FIG. 6D

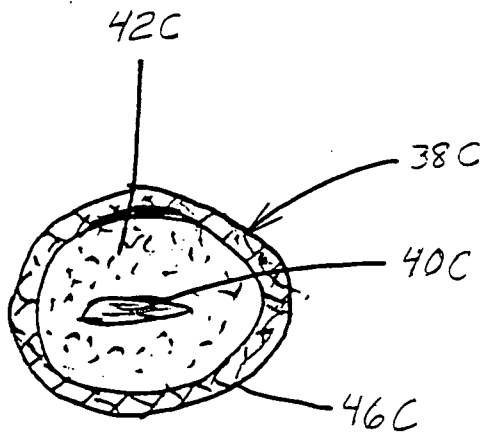


FIG. 6C

FIG. 7

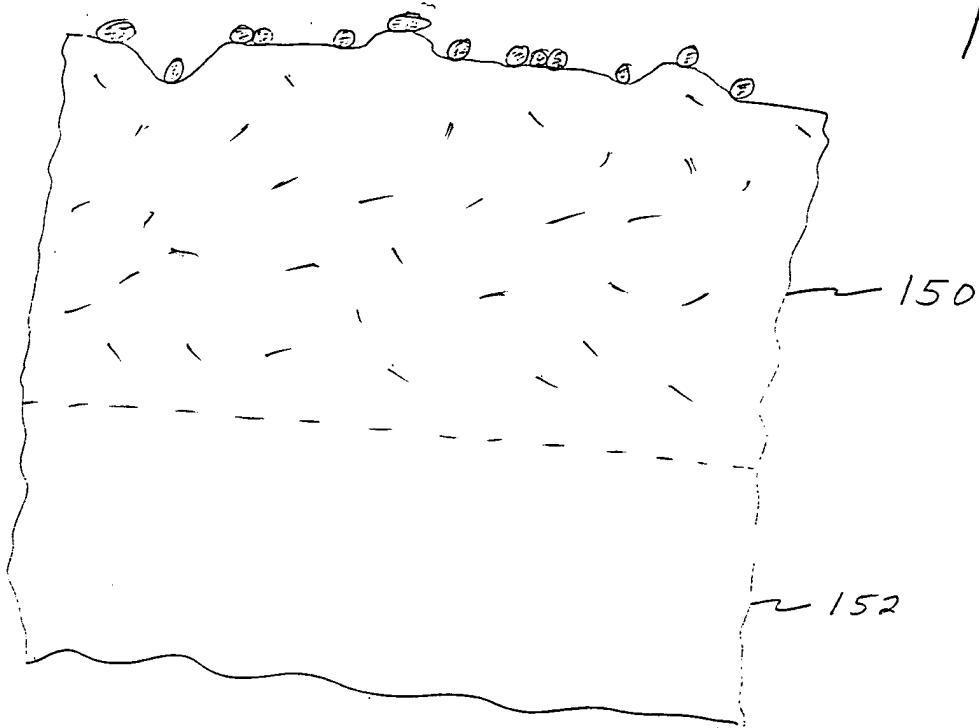
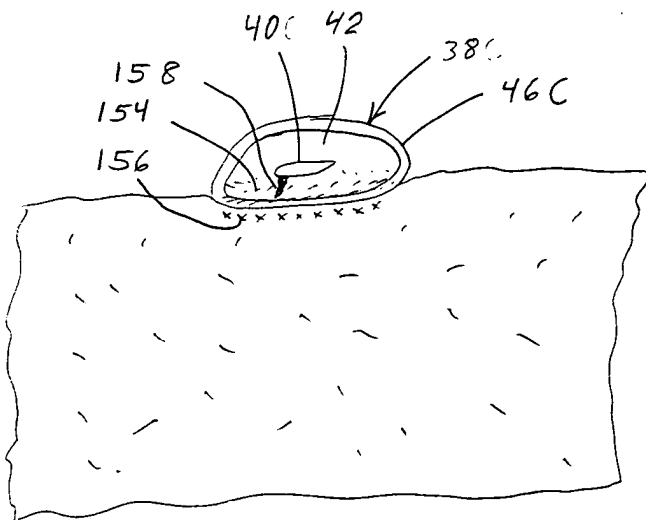


FIG. 8



Also application claims benefit to US provisional 61/52,287 filed 11-97.

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SEEDING TREATMENTS

Field of the Invention

5 This present invention relates to improvements in seed and
seed-related products, processes for making such products and
processes for establishing and improving seed beds and seed bed
germination. As additional benefits, this invention is directed at
improving soil productivity through enhancements in soil fertility,
soil condition/tilth, and control of soil moisture. Further, the
10 invention relates to productive use of certain types of abundantly
available manufacturing waste, which waste is currently being
disposed of in landfills.

Background of the Invention

15 Agricultural growers, gardeners, landscape operators, flower
growers, and the like produce a wide variety of cultivated crops.
Many such crops are grown from seed. The sizes, shapes, and
physical characteristics of the various kinds of seeds are as
varied as the number of crops produced therefrom.

20 Producers of such cultivated crops encounter a variety of
challenges in handling and distributing such seed, as well as with
sowing of such seed in suitable growing media. Certain seed may
desirably be sowed by a broadcast method if the seed were
25 compatible with broadcast application. For example, grass seed for
lawns is desirably broadcast, but the low density and generally
non-aerodynamic shape of some grass seed can limit the range of
such broadcast, and make such seed susceptible to being blown about

by wind, or washed away by surface water, even if initially well placed in a good seeding application.

Another difficulty encountered in sowing seed is that the seed may be so small as to be difficult to handle, thereby to place properly-spaced seeds at a desired spacing as to make cost-effective use of the seed, thereby to produce a crop of the related plants without using any more seed than necessary, thus to gain maximum benefit from the amount of seed used.

While small seed may be efficiently handled by industrial equipment especially designed for handling such seed, typically the user of such seed also handles various other types of seed; and may be unable to justify the cost of such specialty seed-handling equipment. Rather, the seed user typically has a limited range of seed handling equipment which must be capable of being used and/or adapted to handle and apply all the types of seeds being used by that user. Where the seed itself can be adapted to the equipment, specialty seed can be handled without need for any specialized equipment.

Even where the seed may be sown by hand, such as in seedling or bedding trays or pots, some seeds are so small as to be difficult for the sower/user to effectively manipulate and control by hand. Typical of such difficult-to-handle seeds are seeds of lettuce, carrots, the cabbage family, ground cherries, and alfalfa. Many flower seeds are equally small and/or difficult to handle and/or manipulate, for example poppy seed.

When seed is planted, the seed has immediate use for moisture to aid in germination of the seed, and subsequent early development of the resulting young plant. Where moisture is not readily available to the seed when planted, the seed may lie in a dormant state for some period of time before germinating. While the seed is thus dormant, awaiting suitable moisture, the seed is subject to a variety of hazards which may destroy its viability. The seed may be attacked by worms, parasites, and other pests. The seed may be

eaten by foraging animals including insects and larvae. The seed may be overheated by a hot sun. The seed may lie dormant without germinating for so long that any plant emerging therefrom will have insufficient time to mature before the end of the growing season.

5 If and when the seed does germinate, the seedling plant has a continuing need for a proper balance of moisture and oxygen, as well as for such plant nutrients as nitrogen, phosphorous, and potash, as well as the micronutrients, in relatively predictable quantities. To the extent the proper balance of such materials is available to the young plant, a healthy young plant may be produced, with optimum potential for maximum crop production, assuming germination occurs at a seasonably-desirable time.

10 To the extent one or more such materials is not available to the seed and/or the young plant, plant growth, plant health, and ultimately maturity, may be adversely affected. For example, the soil may be too dry to support germination, or optimum germination. Or while the soil may in general have a desired moisture content, moisture content at a macro level can vary widely. Thus, while the soil in general may have a desirable moisture content, the microcosm of the soil adjacent an individual seed may be too dry, or too wet, to support any germination, or optimum germination.

15 Similarly, the soil may be generally depleted of one or more plant nutrients needed by the germinated seedling. Or while the soil may in general have desired nutrient levels, the nutrient levels at a macro level can vary widely. Thus, the microcosm of the soil adjacent an individual seed may be too low in one or more nutrients to support a desired level of plant growth, or so high as to be toxic to a desired level of plant growth.

20 Further, plant nutrient chemicals may be present in the soil, but so tied up chemically in the soil as to be unavailable, or poorly available, relative to the quantities and use rates needed for desired plant growth. Or the soil may become so hard, dry, and/or caked shortly after the seed germinates that the seedling

plant has difficulty penetrating such soil, difficulty becoming associated suitable nutrients, and/or difficulty taking up such nutrients because of insufficient moisture availability.

5 After the plant has further developed such that the plant roots extend deeper into the soil, conditions of the soil near the surface are less critical. However, until such time as the roots so penetrate, conditions of the soil at and near the top surface of the soil may be critical.

10 Soil fertility generally relates to uptake of plant nutrients from the soil by plants. Uptake is generally the result of two factors, the presence of plant nutrients in the soil, and the availability of the plant nutrients for plant uptake. Presence of plant nutrients in the soil is generally a function of the combination of (a) the basic level of soil fertility, (b) depletion by previous crop production and (c) replenishment with fertilizer. Availability of a plant nutrient physically present in the soil for plant uptake is in general related to solubility of the respective nutrient or nutrient combination in a solvent for the nutrient, which solvent is present in the soil, such solvent as water, along with any other material affecting solvation of the plant nutrient into the water or other solvent.

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25 Plant nutrients are routinely depleted from the soil by crop production, and are routinely added back, or otherwise replenished, to the soil by conventional inorganic fertilizers.

25 In order for plant nutrients in the soil to be available for uptake by plants, the nutrients must be held in the soil without excessive leaching, but must not be held so tightly that the nutrients cannot be released for plant uptake. Thus, nutrient availability requires a balance between holding tightly enough to
30 retain the nutrient in the root zone, without leaching, but not so tight as to make the nutrient unavailable for plant uptake. Thus, the general "condition" or "tilth" of the soil is instrumental in

determining the efficiency with which plant nutrients are utilized for plant nutrition.

5 A properly conditioned soil has advantageous soil chemistry in combination with advantageous soil texture. Thus, in addition to providing specific plant nutrients, soil users also use products that modify basic soil chemistry, and soil texture.

Basic soil chemistry is modified by adding to the soil, for example, calcium products to provide pH control, and flyash or like products to provide pH control as well as micronutrients.

10 Soil texture is generally modified by adding to the soil organic matter such as manures, sludges, wood and other plant products and by-products, and the like. While such materials have good soil conditioning properties, plant nutrient value of such materials is fixed and is generally so low that other "fertilizer"-
15 type products must in general be used in addition to the organic matter in order to preserve plant nutrient values in the soil.

The primary object of this invention is to provide solid plant seed capsule products that supply both soil conditioning properties and the seed, which can benefit from such conditioned soil, in a
20 given seed capsule particle.

It is a further object to provide a plant nutrient material, in the seed capsule particle, in amount beneficial to the seedling emerging from the seed, and higher than a naturally-occurring amount of such nutrient in such soil conditioning material, so as
25 to have enhanced chemical nutrient qualities over use of the soil conditioning material alone.

In another aspect, a further object is to provide soil conditioning and optionally nutrient qualities to seed products that reach the soil as the result of fulfilling objectives separate
30 from providing soil fertility or soil conditioning.

Still another object is to provide seed capsules containing fertility-enhancing elements having a high level of plant food

nutrients in combination with a high level of soil conditioning properties.

5 Still another object is to encapsulate a seed in a soil conditioning material using materials rich in plant nutrients as part of the encapsulating agent.

Yet another object is to provide a seed product which reduces the tendency for light weight seeds to be washed away by surface water runoff.

10 Still another object is to provide a seed product which obviates the typical practice of adding straw as a mulch over e.g. grass seed, to protect the seed from being washed away by surface water, from heat of the sun, and to hold moisture in the soil.

15 A further object is to provide products wherein a single seed capsule product particle provides enhanced soil texture and enhanced soil nutrient value at nutrient levels traditionally needed by newly-germinated seedlings, optionally with higher levels of plant nutrient suitably spaced from the seed itself so as to not be toxic to seedling growth, optionally in combination with time-release technology.

20 Yet another object is to provide fertility-enhancing seed capsule products having a suitable level of plant food nutrients in combination with a high level of organic matter as soil conditioning material.

Summary of the Invention

5 The invention generally addresses a combination seed capsule, comprising at least one viable seed, having an outer surface and acting as a core or pseudo-core of said combination seed capsule; and a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed.

10 In general, the coating provides at least one of (i) enhancing broadcast flight properties of the combination seed capsule; (ii) reducing susceptibility to deleterious affects of weather on the combination seed capsule; (ii) enhancing resistance of the combination seed capsule to attack by animals, weeds, or spore-formers; (iv) staged germination of ones of the seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in the seeds; (v) enhancing control of moisture about the seed thereby to assist in seed germination; (vi) release of plant nutrients into soil onto which the combination seed capsule is placed; (vii) soil conditioning effect to soil onto which the combination seed capsule is placed; (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released; (ix) higher embryo emergence and survival rate in a population of the seed capsules, thereby reducing required seed planting density for a desired plant population density; and (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

25 While a wide variety of seeds may be used, in general such seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

30 Preferably, the coating comprises the soil conditioning material in combination with at least one ingredient effective to



reduce susceptibility of the seed capsule to deleterious affect of at least one of animals, weeds, and spore-formers. In some embodiments, the ingredient for reducing such susceptibility of the seed capsule is selected from the group consisting of herbicides, fungicides, for example metalaxyl, and a bitter substance.

In some embodiments, the combination seed capsule further comprises a second coating, separate from the first coating, and comprising at least one ingredient effective to reduce susceptibility of the seed capsule to deleterious effect of at least one of animals, weeds, and spore-formers.

Some embodiments are effective to provide a plant nutrient at a desirable controlled distance from a plant seedling emerging from the seed, in an amount beneficial to the plant seedling.

In other embodiments, the second coating material is intermingled with the first coating material in an outer portion of the first coating, and generally displaced from the seed.

The second coating material can comprise a plant nutrient, beneficial in location and in amount of availability, to a plant seedling emerging from the seed. The second coating composition can comprise an inorganic form of a plant nutrient and can be selected from the group consisting of nitrogen, phosphorus, and potassium. The second coating composition can comprise ^{urea or} an inorganic form of a plant nutrient and can be selected from the group consisting of e.g. ~~urea~~, monammonium phosphate, diammonium phosphate, superphosphate, triple superphosphate, dicalcium phosphate, and potash or a ~~micro~~ nutrient such as sulfur, manganese, copper, boron, iron, magnesium, or chromium.

A population of the seed capsules can comprise coatings having a range of properties affecting germination rate of the seeds, thereby to stage germination of the seeds in the population over a period of time longer than the range of germination times inherent in uncoated ones of the seeds. Such properties can be, for

example, a range of hardnesses, or a range of thicknesses, of the coatings.

5 The coating can comprise a first layer of the soil conditioning material, and a second layer comprising an inorganic, and/or organic, fertilizer, and/or at least one ~~micro~~ micronutrient, such as, for example, sulfur, manganese, copper, boron, iron, magnesium, or chromium.

10 A preferred soil conditioning material is a sludge composition, such as a fiber-containing by-product of a paper making operation, or sewage sludge.

The seed capsule can comprise a water-leachable plant nutrient, and/or a leach-retardant composition, such as wax, effective to retard leaching of the leachable plant nutrient out of the combination seed capsule.

15 In some embodiments, in a population of the combination seed capsules, the coatings in ones, but less than all, of the population, comprise ingredients effective to retard effective penetration of a seed-germinating environment to the seed for germination thereof.

20 In embodiments preferred for some applications, the seed capsule comprises an inner layer on the outer surface of the seed, and an outer layer, the inner layer enhancing properties of the seed for acting as nucleus in an agglomeration operation agglomerating the coating onto the inner layer.

25 In some embodiments, the coating comprises an admixture of the soil conditioner and a plant nutrient.

In preferred embodiments, the coating remains generally disposed about the seed, and preferably but not necessarily remains generally intact about the seed, until the seed germinates.

30 The invention further comprises a plant growing medium extending over an area, the plant growing medium having a root zone, and a top surface of the root zone generally corresponding with a top surface of the plant growing medium, the plant growing

5 medium having a first overall soil condition and texture; and a
population of seed capsules disposed over the top surface of the
plant growing medium, the seed capsules comprising individual
seeds, having outer surfaces, and coatings of soil conditioning
material disposed outwardly of the outer surfaces of the seeds, the
10 coatings of the seed capsules providing localized germination and
growth environments, at and adjacent the seeds, having texture, and
nutrient and water holding properties for supporting seedling
health, superior to respective properties as provided overall in
the root zone of the plant growing medium.

15 The invention yet further comprises a method of providing
plant micronutrients to soil, the method comprising placing onto
the soil a population of combination seed capsules, each comprising
at least one seed, and a coating comprising a plant ~~micro~~nutrient
material.

20 The coating can comprise a first coating comprising the plant
~~micro~~nutrient, and a second coating, separate and distinct from the
first coating, and comprising a soil conditioning material.

25 The invention yet further comprehends a method of providing a
seed bed having enhanced growing conditions for growing seed, the
method comprising coating a population of the seeds with a coating
material, and thereby providing coatings thereon of such material,
the material tending to stabilize, in the seed capsules, or in soil
on which the seed capsules are disposed coating compositions which
30 tend to hold, moisture adjacent the seeds in the seed capsules or
in soil adjacent the seed capsules, in such quantities and for such
times as to enhance growing conditions for the seeds; and placing
the population of seeds on soil effective to support germination of
the seeds which are in the seed capsules.

In some embodiments, the seed capsules comprise inner layers
on the outer surfaces of the seeds, and outer layers, the inner
layers enhancing properties of the seeds for acting as nuclei in

agglomeration operations agglomerating the coatings onto the inner layers.

5 The invention yet further comprehends a method of making a population of combination seed capsules, each comprising a seed, and a coating of a soil conditioning material, the method comprising pre-coating the seed with a material which enhances the ability of the seed to act as a nucleus in an agglomeration operation, to form a pre-coated substrate; and subsequently coating the pre-coated substrate with a soil conditioning material.
10 A preferred pre-coating material comprises dicalcium phosphate.

In general, the pre-coating step typically results in an overall increase in the density of pre-coated seed combination. The pre-coating step can be accomplished by, for example, spraying the pre-coating material onto the seed, and subsequently driving off such as by drying, as necessary, any solvent or other liquid carrier used for application of the coating material to the seed.

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In yet other expressions, the invention comprehends a method of providing an enhanced seed germination environment in combination with placement of a controlled amount of plant nutrients in controlled proximity to each seed, the method comprising providing a population of seeds, coated with a soil conditioning material which tends to enhance germination of the seeds, and with plant nutrient composition effective to enhance growth of plant embryos emerging from the seeds; and placing the population of seeds on soil effective to support germination of the seeds. In such method, the coating material can include a second ingredient comprising plant nutrient moieties.

Brief Description of the Drawings

FIGURE 1 is a transverse cross-sectional view of a coating drum suitable for spray-coating substrate seed according to the present invention.

FIGURE 2 is a partially cut away view showing a length of the drum of FIGURE 1.

FIGURE 3 is a schematic representative flow diagram illustrating a first manufacturing process for producing combination seed capsule product of the invention.

FIGURE 4 is a block diagram illustrating a second manufacturing process for producing combination seed capsule product of the invention.

FIGURE 5 is a schematic representative flow diagram illustrating a third manufacturing process for producing combination seed capsule product of the invention.

FIGURES 6A, 6B, 6C, and 6D show cross sections of seed capsules of the invention.

FIGURE 7 illustrates a cross-section of the soil root zone, and a representative population of seed capsules at the top surface of the soil.

FIGURE 8 illustrates a single seed capsule on the soil surface, and the micro-environment developing about the seed capsule.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

5 The following is a detailed description of the illustrated
embodiments of the present invention which provides combination
seed capsule products that provide for a combination of efficient
and proper seed placement in the soil, soil conditioning properties
at the specific site of the seed, plant nutrients at or near the
specific site of the seed, ingredients effective to reduce
deleterious effects of spore-formers and animals, and/or other
10 various physical benefits/properties of the combination seed
capsule not previously available in a single product.

15 In general, at least one seed substrate and at least one soil
conditioning material are selected as raw materials, and are
combined to make a combination soil conditioning seed capsule
product of the invention.

20 The invention can operate with any of a wide variety of soil
conditioning materials such as municipal or other sewage sludge,
scrubber sludge, paper mill sludge, fly ash, dust, animal waste,
other organic materials, and mineral soil conditioning materials.

25 The soil conditioning material can be a solid material having
a melting temperature so high that handling such material in the
melt state is impractical and/or undesirable in view of the limited
temperatures at which the seed will remain viable. For example,
the soil conditioning material may be combustible at a temperature
lower than its melt temperature, or will melt only above
temperatures which can be tolerated by the seed, such that
viability of the seed would be destroyed if melting were attempted
in an environment which exposed the seed to such temperatures.
Thus, handling such material in the melt state is impractical,
30 whereby other methods of handling the soil conditioning material
may be desired.

Solid sewage sludge, sawdust, and solid animal waste are
representative of soil conditioning materials which cannot be

readily melted. In the alternative, some soil conditioning materials such as sewage sludge, paper mill sludge, sawdust, and solid animal waste can be suitably comminuted and then dissolved or suspended in water or other solvent composition for processing purposes, optionally along with other soil conditioning materials and/or inorganic chemical fertilizer materials, and the solvent subsequently driven off to make a resulting solid product.

~~Inorganic~~ chemical fertilizers generally are distributed in commerce as solid state materials. Such material is generally produced in manufacturing steps either in solution or in the melt state to meet a specified narrow range of size, hardness, and plant nutritional characteristics, distinct to the application of each such product. Examples of such fertilizers include nitrogen, phosphorus, and potassium containing products such as urea, monoammonium phosphate, diammonium phosphate, superphosphate, triple super phosphate, dicalcium phosphate, potash, and the like. The ~~inorganic~~ chemical fertilizer can be a mixture or other physical combination of known inorganic fertilizer chemicals, and may include desired amounts of ~~micro~~ nutrients such as sulfur, manganese, copper, boron, iron, zinc, and the like.

In preferred embodiments of this invention, a precursor seed capsule, having one or more coatings of the soil conditioning and/or other material thereon may first be prepared as a solid or semi-solid particle or agglomerate. The soil conditioning raw material may be a particulate powder, or may be fibrous, or may be a suspension of a powder or fibrous material in a liquid carrier, and is preferably coated onto the substrate seed to form a seed capsule or other agglomeration of particles, fibers, or the like. Where the soil conditioning material is, for example, sewage sludge, the sewage sludge raw material can be obtained as a slurry that may be bound together as with a binder, preferably an organic binder, when dried. The slurry may be spray-applied to the substrate seeds, for example to a rolling bed of such seeds, in

5 combination with a flow of air to evaporate water from the thus-applied coating. Such sewage sludge, or paper mill sludge, need not be reacted or otherwise treated with any acid, caustic, or any other chemical before being applied and/or dried, or partially dried, either in preparation for, or after, the slurry application of the sludge to the seed substrate.

10 Specifically, the sewage sludge or paper mill sludge used herein as soil conditioning raw material need not be treated to transform such sludge into colloidal form. Thus, the sludge preferred for use herein is generally non-colloidal in nature, and is distinguished by its non-colloidal nature from conventional sludges which are specifically treated to provide the colloidal characteristics thereto.

15 Natural lignin, lignosulfonates, and the like, may serve as suitable binders where the soil conditioning material is, for example, paper mill sludge, raw wood, sewage sludge, or other organic or inorganic material. In the case of, for example, calcium chloride or other inorganic additives, such materials may be added to the primary coating, e.g. onto or into the sludge coating, by well-known processes.

20 Soil conditioning material used herein may be devoid of such conventional plant nutrients as nitrogen, potassium, and phosphorous, or may have such limited plant nutrient value, or may be so unbalanced in nitrogen, phosphorous, and potassium content, that the soil conditioning material may not, by itself, be a desirably complete material for use as the only ingredient in the seed coating. Thus, such soil conditioning material may have limited application herein where basic level of soil fertility is seriously degraded. However, all soil conditioning materials contemplated herein beneficially modify soil to which they are applied, in some way other than direct provision of nitrogen, phosphorous, and/or potassium or other plant nutrients. By use of soil conditioner in intimate association with the seed, this

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invention not only enhances soil condition of the growth medium/soil to which it is applied, it also provides soil conditioning value to the seed so coated, and in intimate association with the seed, irrespective of the general tilth condition of the growth medium into or onto which the seed capsule is applied.

Further to preferred embodiments, typically a first coating material (e.g. soil conditioning material) is readily converted into liquid state such as liquid suspension, and is provided to the process as a liquid. As a general statement, the first coating material may be sprayed onto the substrate seed, then is converted back to solid state on the thus-created seed capsules or seed capsule precursors. In the alternative, the coating material may be mixed with the seed in an (e.g. ribbon) blender, or may be otherwise coated onto the substrate seed in an agglomeration process according to well-known conventional agglomeration principles.

Regarding the coating process, the coating material can accumulate as a single or multiple layer coating on the outside of the seeds to form a population of combination seed capsules. The layer or layers of coating material can be a homogeneous or heterogeneous mixture of the desired elements. Further, such population of combination seed capsules can have a range of hardnesses and thicknesses for improved seeding treatments.

Cooperating inner and/or outer layers may be used e.g. to control direct contact between the seed and moisture. Suitable materials and processes therefore are taught in USA Patent 3,698,133 Schreiber and 4,759,151 Gerber, and are thus well known in the art.

In some embodiments, a second coating material may penetrate into the layer of soil conditioning coating material. Such penetration may comprise a generally uniform distribution of the second coating material throughout the first coating material, or

may represent a more stratified or otherwise heterogeneous distribution of second coating material in or on the first coating material.

5 In other embodiments, the coating materials may be mixed into a heterogeneous layer. Such layer or layers of heterogeneous material can then be coated upon the outside surface of the seed.

10 Where the liquid state of a coating material was obtained by slurring or otherwise combining the coating material with water, the liquid fraction is reduced after application of the liquid-state material to the substrate seed, or to the growing seed capsule, to effect solidifying of the coating material after application of the coating material to the substrate seed. The liquid fraction is reduced by driving off the liquid carrier, as by medium or low temperature air, or vacuum or other flash drying, after or during application of the coating material to the substrate seed. The resulting solid seed capsule, comprising the seed coated with the e.g. sludge coating material, is then recovered as a combined soil conditioning seed capsule product of the invention.

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30 Spraying of the liquid coating material can be accomplished by a variety of known processes such as, but not limited to, pneumatic, hydraulic, or electrostatic spraying processes. The temperature and pressure of the material being sprayed depends on the material selected, and the viscosity and other parameters of the respective material in the respective liquid state. While high atomization is desired, such is not critical. The liquid coating material need only be atomized sufficiently to provide a generally uniform coating on the substrate seeds, as determined after the coating and solidification steps in fabricating the seed capsule product are completed.

Indeed, the uniformity of coating or coating thickness about the seed is typically not critical so long as the seed is not on or immediately adjacent an outside surface of the capsule such that

the seed may fall out, or be easily broken out, of the capsule, or easily removed by dissolution of materials at and near the surface of the seed capsule. In addition, the seed should not be so near the outside surface of the capsule as to be in a nutrient layer having such high concentration of nutrient as to be toxic or otherwise detrimental to viability or growth of a plant emergent from the seed.

Spray application of the coating is suitably controlled to achieve the required addition of the spray material, liquid and/or powder, coating to the substrate seed or precursor seed capsule. An illustrated method of applying the liquid material to the substrate seed or precursor seed capsule is by using a rotating drum spray-coating apparatus. Other apparatus and methods, for example a tilted pan coating process, can be used to apply the soil conditioning material and optionally an ~~inorganic~~ chemical fertilizer material onto the substrate seed. The coating operations can be batch operations or continuous operations.

As illustrated in FIGURES 1, 2, and 4, spray apparatus can operate within a rotating drum disposed in a generally horizontal orientation. The drum may incorporate internal lifting flights which lift free-flowing (e.g. seed and growing seed capsule) particles in the drum and then let the particles fall to the bottom of the drum as a continuously falling curtain or cascade. In some embodiments, the interior of the drum is either clean and free from any flighting, or has only mixing fingers or flights that expand the area covered by the bed, that keep the bed rolling as the drum rotates, and that generally improve mixing, rather than lifting particles to the top of the drum and then releasing them in a falling cascade. However, such lifting of particles to the top of the drum, and corresponding falling cascade or falling curtain, are not excluded from processes of the invention. Rather, both such finger mixing, and such lifting coupled with falling cascade or curtain, are included within the scope of the invention.

19 p. 261

Stationary spray nozzles are positioned within the drum to project the sprayed material onto the rolling bed, and optionally onto any curtain or cascade of falling particles. For a continuous process, the drum is preferably inclined at a small angle from horizontal, such as, without limitation, about 0.25 inch to about 0.38 inch from the horizontal for each foot of length of the drum, so that rotation of the drum causes the particles to move from the inlet end of the drum to the discharge end, while maintaining a relatively uniform bed thickness. The optimum degree of incline varies with each set-up and may thus be outside the above range. The important parameter is that the incline contribute to maintaining a bed of seed and seed capsule particles having sufficient uniformity that the spray material can be effectively applied to the particles passing through the drum. The particles are then discharged at the discharge end of the drum.

FIGURES 1 and 2 show schematically a first embodiment of processing equipment which may be used to produce seed capsules of the invention. Such processing equipment includes a drum and sprayer combination suitable for continuously producing coated seed capsules in accord with the invention. Use of the illustrated drum and sprayer combination is not critical, however, as other drum and sprayer combinations, or other coating methods such as pan coating methods, are also suitable. *Referring to* FIGURES 1 and 2, drum **10** has an inlet end **12** for receiving the substrate seed material or materials, or partially formed or pre-coated seed capsule precursors. Drum **10** has a discharge end **14** through which agglomerated or otherwise coated seed capsule product particles are discharged over discharge retaining ring **16**. A variable speed rotary drive (not shown) is provided for supporting and rotating the drum **10** in a counterclockwise direction as viewed in FIGURE 1 at controlled, and changeable drive speeds. Conventional slope adjustment apparatus (not shown) is provided for routine and ongoing adjustment the slope of the drum from horizontal.

Air is preferably supplied from discharge end **14** as shown in FIGURE 2, and flows countercurrent to the direction of travel of the seed substrate material. Since the contemplated coating materials are generally applied to the seed in liquid, or semi-liquid, or other moist form, and since some coating materials may thus tend to form clumps or otherwise self-agglomerate when exposed to ambient moisture conditions, air supplied at discharge end **14**, and elsewhere in the process for contact with the coated seed and seed capsules, is preferably dried in order to cost-effectively remove an optimum amount of the moisture from the coating material and to assist in maintaining suitably low moisture content in the thus coated and dried seed capsules.

A first stationary spray assembly **28** extends longitudinally within drum **10** above and adjacent the bed **20** of seed and/or seed capsules. First spray assembly **28** includes pipe **29** and nozzles **30**. A second spray assembly **32** extends longitudinally within drum **10** generally adjacent first spray assembly **28**. Second stationary spray assembly **32** includes pipe **33** and nozzles **34**, which transport the material to be sprayed. Nozzles **30** and **34** are connected to pipes **29** and **33** respectively, and project sprays of liquid or otherwise particulate coating material toward the bed of seeds and/or seed capsule precursors. The description of spray assemblies **28**, **32** as stationary means that the spray assemblies do not rotate with drum **10**. However, the positions of either nozzles **30**, **34** or pipes **29**, **33**, or both, can be adjusted within the drum for proper direction of the respective spray or sprays onto the bed of seeds and/or seed capsules or seed capsule precursors.

A stationary protective cover **24** is mounted over the spray assemblies. Seeds and/or seed capsules falling from the inner surface of the drum and the flights, above the spray assemblies, fall onto the cover, and are deflected away from the spray assemblies, as shown in FIGURE 1. Thus, cover **24** protects the

pipes and nozzles from the falling seeds and seed capsules falling onto and fouling the pipes and spray nozzles.

As drum **10** rotates, flights **22** lift and mix the seeds, seed capsule precursors, and seed capsules, but do not generally carry the bulk of the seeds and seed capsules up to the top of the drum. Some small amount of seeds, seed capsule precursors, and seed capsules will be carried upwardly to the top of the drum by even a drum devoid of any flights. Thus, all drums experience some amount of seeds and seed capsules falling from the upper part of the rotating drum whereby cover **24** is beneficial for protecting spray assemblies **28** and **32**.

Preferred flights **22** are primarily directed toward enhancing mixing of the bed **20** of seeds and seed capsules, continually refreshing the surface of the bed with a newly-emergent supply of seeds and seed capsules, rather than lifting and subsequently dropping the seeds and seed capsules which may be fragile when initially coated. To that end, each flight **22** preferably, but without limitation, has a leading surface **23A** extending at an obtuse angle "A1" of at least 90 degrees with respect to the inner surface of the drum. A more preferred angle "A1" is about 100 degrees to about 150 degrees. Trailing surface **23B** of flight **22** can be virtually any angle, with the inner surface of the drum, which angle does not interfere with the operation of adjacent leading surfaces **23A**.

Additional retaining rings can be added to the assemblage shown in the drawings, in order to provide that height "H" to the retaining ring which will provide and maintain the optimum configuration of bed **20** inside drum **10**.

As noted above, inlet end **12** of the drum may be raised above discharge end **14**. When in use, the drum rotates continuously. Seeds or previously thinly-coated or partially-coated seed capsules are continuously fed into inlet end **12** and thus added to rolling bed **20**. Flights **22** continuously mix the bed as the drum rotates,

refreshing the bed surface with newly fed seeds, or seeds and seed capsules newly brought to the surface by the continuous rotation of the drum in combination with the mixing action of the flights. Spray assembly **28** sprays the desired coating material (e.g. sewage sludge, paper mill sludge, or other coating composition, onto the continuously moving and mixing surface of bed **20** from a plurality of nozzles **30** distributed along the length of pipe **29**, and similarly along the length of drum **10**, adding the sprayed material to the seeds and seed capsules in bed **20**. After receiving the spray coating from spray assembly **28**, the seed capsules are discharged through discharge end **14**. In some embodiments, the seed capsules pass through a cooling chamber, not shown, integral in drum **10**, before being discharged through discharge end **14**.

In general, as the seeds traverse the drum, from inlet to discharge, nozzles **30** atomize the liquid or other coating material and spray such atomized coating material as e.g. droplets of the coating material onto the seeds in the bed. The result is that the seeds become generally uniformly coated with one or more layers of the coating material such that the coating material becomes an integral part of the respective seed capsules fabricated in the drum. As the coating material solidifies on the seeds, the coating material tightly bonds to the respective portions of the seeds.

As the seeds and seed capsules roll and mix with rotation of the drum, the incline of the drum causes the seeds and seed capsules to travel from inlet end **12** toward discharge end **14**.

In the alternative, or where a coating material is not readily self-bonding to the seed material, a binder material can be provided toward the inlet end of the drum at spray assembly **32**, through pipe **33** and nozzles **34**. In such embodiment, the binder is preferably sprayed onto the seeds closer to inlet end **12** rather than along the entire length "L" of the drum. The coating material is then preferably sprayed onto the seeds downstream from the inlet end, and preferably relatively downstream of nozzles **34**. Thus, the

seeds receive a first coating of the binder, and a subsequent second coating of e.g. liquid soil conditioning coating material overlying the binder.

Binder material applied as e.g. through spray assembly **32** may contain additional coating components such as e.g. flyash, lime, gypsum, or the like, as one or more components for assisting in adding bulk and thickness to an inner binder layer prior to any, or the majority of, the application of the organic coating material (e.g. sewage sludge or paper mill sludge).

In some embodiments, binder and liquid soil conditioning coating material are applied at similar locations along length "L" of the drum whereby binder and soil conditioning coating material may become intermingled/mixed before reaching the seeds, or on the seeds. For example, liquid soil conditioning coating material may be sprayed onto the seeds along the full length of the coating chamber in drum **10** while spraying of the binder material onto the substrate seeds is done relatively closer to or adjacent the inlet end of the coating chamber of the drum. Thus, a first binder layer may underlie or be mixed with the soil conditioning coating material, and may be overlain by a second layer of the soil conditioning coating material. Thus, in this embodiment, the binder layer may typically be a combination of binder material and coating material.

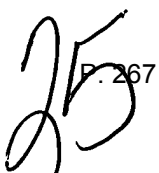
Further, it is contemplated that the soil conditioning coating may be applied first, followed by application of binder or inorganic fertilizer or sealer coating, in which case the binder or inorganic fertilizer or sealer may serve as an outer shell, temporarily trapping the inwardly-disposed materials inside the seed capsule. In the alternative, the soil conditioning coating may be applied first, followed by application of the binder, and wherein the binder penetrates through the soil conditioning coating, either physically or chemically, to the underlying substrate seed and there provides the binding property.

24

Additional spray assemblies can be provided, spraying additional materials (e.g. inorganic fertilizer materials) onto the substrate seed. Thus, e.g. 6 spray assemblies can spray 6 different coating materials onto the substrate seed. For example, a first spray material can be a binder or primer material intended primarily to enhance bonding of subsequent sprays to the substrate seed. Continuing the example, a second spray can be a combination of binder and finely comminuted particulate material such as lime and/or flyash. A third spray may be a soil conditioning material such as a paper mill sludge or a municipal sewage sludge. Fourth, fifth, and/or sixth sprays can add nitrogen, phosphorous, and/or potassium plant nutrient ingredients, alone or in combination, or as combinations. In this manner, the soil conditioning properties of the seed capsule can be established, and the plant nutrient level of the seed capsule can be enhanced to provide substantially any level of major and/or minor plant nutrients desired in the seed capsule, at substantially any relative ratios of the respective plant nutrients, and wherein the preferably primarily soil conditioning coating provides desired soil conditioning properties in the resulting product, initially for use by the specific seed contained therein, and ultimately as additive to the overall tilth of the growth medium such as soil into or onto which the seed capsule is eventually planted.

A preferred, and rather simplistic, embodiment of the invention is provided by spraying a soil conditioning liquid suspension of sewage sludge or paper mill sludge onto seeds to be encapsulated to make seed capsules. By controlling the amount of the soil conditioning sludge, or by controlling the residence time of the seeds in the drum, a desired thickness of soil conditioning coating can be provided in the resulting coated product.

Typical dried sewage sludge, as a raw material, contains about 2-6% nitrogen, up to about 2% phosphorous, and generally no potassium, and thus has little or no market value as a fertilizer



(plant food) product per se. However, by adding e.g. urea, the nitrogen content can be raised if desired, especially as a coating on or adjacent the outside surface of the seed capsule, whereby the combination fertility-enhanced, soil conditioning, seed capsule product has real market value as a comprehensive, self-contained, value-added, seed capsule product. Such product thus contains the seed, a soil conditioning composition which operates somewhat as a seed incubator providing a beneficial germination environment, and a starter quantity of fertilizer selected in quantity and placed in location so as to provide improved, ideally optimum, amounts of plant nutrients at optimum location for use by the newly-emerged embryonic plant at the germination stage of seed development.

Starting with a sludge coating having 2% by weight nitrogen, sufficient urea may be added to bring the nitrogen content to, for example, 5%, 7%, 8% or 10% nitrogen, or more, depending what analysis is desired. Starting with a sludge coating having 6% nitrogen, sufficient urea may be added to bring nitrogen content to, for example, 10%, or whatever other analysis is desired. Phosphorous and/or potassium components and/or materials having combinations of plant nutrient elements (e.g. NPK) can, similarly, be added to the sludge, either before, after, or during addition of the urea. In addition, nitrogen, potassium, and/or phosphorous-containing materials can be combined with the sludge prior to the sludge being applied to the seed.

It should be understood that the more porous the established soil conditioning coating, or e.g. the outer surface of such coating, the more any subsequent spray material penetrates the established coating. All such penetration is contemplated in use of the term "coating" herein.

In some preferred embodiments, the overall coated combination seed capsule product comprises seed capsules wherein substantially the entirety of the soil conditioning material is confined to a contiguously-defined portion of the seed capsule. In such

embodiments, the structures of the finished product seed capsules comprise coatings of contiguously arranged elements of the soil conditioning material, generally arrayed entirely or substantially entirely about the seed, which coatings may be overlain by an additional layer, optionally discontinuous, of organic or inorganic chemical fertilizer. Further coating layers of either soil conditioning material or organic or inorganic chemical fertilizer can be applied over the additional layer.

In addition, or in the alternative, other layers of other materials whether soil conditioning materials, organic or inorganic fertilizers, or other materials, can be applied to the substrate seed before applying the above mentioned layer of soil conditioning sludge. Thus, the substrate seed can be coated with a layer of a calcium compound e.g. calcium chloride, calcium carbonate, or dicalcium phosphate, or with a sulfur moiety, and/or a further layer of urea, all with optional use of binder materials.

Further to the structure of the seed capsules of the invention, the coatings on the seed capsules need not generally represent a uniform mixture of the inorganic chemical fertilizer and the soil conditioner. Rather, in a typical seed capsule a core substrate seed is overlain or encapsulated by a soil conditioning material, and is generally free from a second overlying soil conditioning coating material, and wherein the inorganic fertilizer content at the seed/coating interface is relatively higher so as to represent a second coating material such as an inorganic fertilizer coating, as compared to the inorganic fertilizer content at locations at and adjacent the seed.

The second coating can, and preferably does, in some embodiments, penetrate into voids or other interstices in an underlying e.g. soil conditioning coating. However, preferably most if not all elements of the underlying e.g. soil conditioning coating material are generally interconnected with each other without intervening coating material of the second layer, except

for an optional binder used to hold the first coating material together as a unitary structure, separate from any structure and bonding provided by the second coating material.

5 While the combination seed capsule can comprise discontinuities in the soil conditioning sludge coating layer, in combination with an inorganic fertilizer material in such seed capsules, such compositions are less preferred.

10 Regarding the coating process, FIGURE 4 illustrates in flow sheet form a manufacturing process for producing seed capsules of the invention, using the coating drum 10 as described above. It should be understood, however, that other equipment such as a pan pelletizer, a paddle mixer, or the like can be used in place of the rotary drum to obtain combination seed capsules of the invention.

15 The coating process operates according to conventional and generally well known agglomeration principles, as described by Wolfgang B. Pietsch in an article entitled "The Agglomerative Behavior Of Fine Particles." Such coating process uses water and heat, along with physical and/or chemical adhesives and like properties, to bind or agglomerate a plurality of types of particles and/or materials into coated seed capsules, each typically containing an individual seed.

20 To obtain agglomerates from relatively smaller particles of raw materials, binding forces must act within the individual developing agglomerate particles. According to known agglomeration principles, five different binding mechanisms are known to be useful for building agglomerate particles including solid bridges, interfacial attractions and capillary pressure, adhesion and cohesion, attraction between solid particles, and form-closed bonds.

25 30 At elevated temperatures, solid bridges can form by diffusion of molecules from one particle to another at the points of contact. Heat can be introduced from an external, secondary source or created during agglomeration by friction and/or energy conversion.

Solid bridges can also be built up by chemical reaction, crystallization of dissolved substances, hardening binders, and solidification of melted components.

5 Capillary pressure and interfacial attraction forces in liquid bridges can create strong bonds that disappear if the liquid evaporates and no other binding mechanisms take over.

10 Highly viscous bonding media such as tar and other high molecular weight organic liquids can form adhesive and/or cohesive bonds very similar to those of solid bridges. Thin adsorption layers are immobile and can contribute to such bonding together of fine particles under certain circumstances.

15 Typical short-range forces of the van der Waals electrostatic or magnetic type can cause attraction between solid particles whereby the particles stick together if such particles are sufficiently close to each other. Decreasing particle size clearly favors such attraction between solid particles.

Fibers, little platelets or bulky particles can interlock or fold about each other resulting in "form-closed" bonds.

20 Now referring to FIGURE 3, in some embodiments of the coating/agglomeration process, it is desirable to pre-coat the seeds prior to implementing agglomeration principles to produce the above described coating of soil conditioning material. Such embodiments comprise light-weight and/or elongate shaped seeds (i.e. grass seeds), or other similar type of seed which may not
25 readily or inherently serve as a nucleating agent in a conventional agglomeration process with the respective soil conditioning material which is desired to be coated on the seed. Pre-coating the grass seed, for example, enhances the agglomeration of paper sludge as a coating material, of binder and/or of other coating
30 substances, by increasing the weight of the pre-coated grass seed and by providing a more filled in, more rounded shape to such long and narrow seeds. The increased weight and more filled in shape of the grass seed enables more effective, more efficient, processing

of the seed in coating apparatus such as that illustrated in FIGURES 3 and 4.

Referring to FIGURE 3, the form and composition of such pre-coating, when needed, can vary according to the weight, shape, composition, and surface properties of the seeds, and according to the binder, if any, the soil conditioning coating or coating materials to be applied, and any other inorganic or organic coating material to be applied.

The seeds, whether pre-coated or not, are received within the rotary drum where the soil conditioning material is spray coated onto the substrate seeds to obtain combination seed capsules.

Before coating the seeds with a soil conditioner, the organic soil conditioner material (e.g. paper sludge) is preferably processed through a dryer such as a rotary drum dryer, as needed, to reduce the amount of moisture in the organic soil conditioner material to less than about 8% water by weight. Such drying is an essential step where the material is otherwise above the nominal 8% effective water content, to enable grinding the sludge to a size less than US Standard 20 mesh screen, and to prevent the particles from agglomerating with each other. Certain of the coating materials, e.g. fly ash, because of their physical properties, need not be dried before being ground to a suitable size for participating in the agglomeration operation.

The seeds, whether pre-coated or not pre-coated, and the one or more soil conditioners, are received within a mixer where growth enhancers such as time release agents and/or other environmental conditioners may be added to form a combination seed capsule. The thus pre-coated seeds are then received into a pan pelletizer, a rotary drum, or the like, where binders such as lignin, lignosulphonates, molasses, sodium silicate, wax, monammonium phosphate, or urea can be added and thereby coated onto the pre-coated seeds. Other materials which can be added to the seed capsule at the e.g. rotary drum include anti-fungal coatings such

as with metalaxyl fungicide, for example, Apron® and/or Subdue®, available from Novartis, Inc. of Greensboro, North Carolina.

5 The such-coated seeds are then passed into a rotary or other dryer in order to obtain a seed capsule containing 5% or less water. The maximum water fraction in the coating can vary according to the composition of the coating material, so long as the resultant seed capsules remain suitably structurally strong and so long as a population of such coated seed capsules remains free flowing in solid condition. The process for fabricating the seed capsules must maintain a temperature sufficiently low that the seeds are not heated so hot that viability of the seeds, for germination purposes, is not dramatically compromised. It is generally preferred that the temperature of the seeds be suitably controlled such that any binder and/or coating material, or other materials applied to the seeds, cool at a controlled rate while bonds form between the seeds, or seed capsule precursors and the one or more soil conditioning and/or other coating materials. Such temperatures of all materials are suitably controlled to avoid decomposition of the respective materials, loss of viability of the seeds, or breakage of seed capsules or seed capsule precursors, or coatings or coating or other materials during such processing. The temperature at the rolling seed bed inside drum 10 generally can range from about 130 degrees F to up to at least 230 degrees F for seed residence times up to at least 1 hour. At drum operating temperatures of less than 130 degrees F, drying time can become excessive. At temperatures above 230 F, the viability of the seed may be at risk, depending on the sensitivity of the seed, residence time, and other influential parameters.

25 The above stated temperature range is illustrative and not limiting, and will vary depending on the seed, the coating materials, and the specific process parameters of a particular coating system and coating operation. Thus, maximum e.g. drum coating temperatures can be less than 130 degrees F or more than

230 degrees F. However, the stated range is preferred, including all temperatures within such range such as, for example, 150 degrees F, 180 degrees F, 210 degrees F, and the like.

5 Referring to the drum of FIGURES 1 and 2, and to the pan pelletizer block in FIGURE 3, the seeds are fed continuously to an inlet as at inlet end **12** of drum **10**. Combination seed capsules, produced as described above, are released from a discharge locus such as discharge end **14** of the drum to a sizing apparatus **36** in which the seed capsules are sized through conventional sizing elements. Suitably-sized seed capsules are discharged from the 10 sizing apparatus as product for distribution. Undersize seed capsules are fed back into mixer as shown in FIGURE 3. Oversized seed capsules are fractured and screened for reprocessing.

15 The recovered seed product can be further coated with any of the coating materials described above, such as urea or other inorganic or organic fertilizer, and/or with growth enhancers or other desirable materials. Further, other types of coating materials such as water repellants can be coated onto the discharged seed capsules for the purpose of importing additional desirable properties to the seed capsules. 20

25 In the process of coating porous organic materials such as sewage sludge or paper mill sludge as is optional in the invention, with a second material which is applied for other than imparting soil conditioning properties, for example an inorganic fertilizer, the general size of the coated seed capsule may be the same after applying the second material (e.g. inorganic fertilizer) as the size of the previously-coated seed capsule, or may be similar in size. Namely, the quantity of coating material added to the seed capsule can be so small as to not materially affect seed capsule 30 size, or the coating material can be received into an e.g. porous interior of the soil conditioning coating of the seed capsule, or both.

38
D 274

It is contemplated that the operation and functions of the invention have become fully apparent from the foregoing description of elements, but for completeness of disclosure, the usage of the invention will be briefly described.

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EXAMPLE 1

10 A coating drum as illustrated in FIGURES 1, 2 and 4 is used to place a coating of paper mill sludge on grass seed. Raw material grass seed about 4-6 millimeters long and about 0.5-1.0 millimeter thick, is continuously fed to pre-treater 11, where the seed is blended with powdered lime, powdered flyash, and a lignosulfonate binder, to form partially-developed seed capsules comprising seeds coated with relatively thinner coatings of the recited mixture of coating materials. The partially-developed seed capsules are continuously fed to inlet end 12 of drum 10, to form a bed 20 of the partially-developed seed capsules. The drum rotates continuously. The rolling of the drum, and the associated mixing affect of the flights, provide a constantly changing top surface of the bed. A paper mill sludge slurry is supplied in pipe 28 at pressure sufficient to atomize the liquid sludge slurry. A liquid sludge slurry is thus sprayed from nozzles 30 onto the top surface of the bed of partially-developed seed capsules, applying a sludge coating on those partially-developed seed capsules which are at the upper surface of the bed at any given point in time.

25 The resulting seed capsules, of paper mill sludge coated seeds, have a coating of soil conditioning sludge thick enough to make the material a product marketable for its soil conditioning content as well as for the seeds contained therein. Increased levels of nitrogen and/or other plant nutrients can be added by, without limitation, providing sprays of the other desired materials, preferably subsequent to at least the initial sludge slurry spray. Other materials can be included in one or more of

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F. 275

the sprays e.g. to retard or enhance moisture permeation into or out of the combination product in accord with the anticipated storage and/or use environment of the product.

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EXAMPLE 2

FIGURE 5 illustrates the equipment used in this EXAMPLE 2. As seen therein, grass seed, lime, flyash, and calcium lignosulfonate binder are fed to ribbon blender **111** by respective screw feeders **112A**, **112B**, **112C**, **112D** respectively. Ribbon blender **111** encapsulates the seed with a thin layer of the mixture of lime, flyash, and lignosulfonate to thereby make partially-formed seed capsules. The partially-formed seed capsules are discharged from the ribbon blender and conveyed by conveyor **114** and belt feeder **116** to a tilted-pan pelletizer **118**, which rotates about a fixed axis.

Paper mill sludge is received into a weigh hopper **120** at about 60% by weight water, and is fed by screw feeder **122** and belt **124** to pin mixer **126**. The pin mixer breaks down the fiber and fiber clusters of the sludge into loose separate fibers, and discharges the resultant material onto conveyor **128** which transports the material to screw feeder **130**, and thence into the tilted pan pelletizer.

In the tilted pan pelletizer, the partially-formed seed capsules, (seeds being coated with lime, flyash, and lignosulfonate) are mixed with the comminuted paper mill sludge and thereby coated with the sludge. By operation of the tilted rotating pan pelletizer, the larger seed capsules generally rise to the top of the bed of seed capsules in the pan, and as additional material (sludge and partially-formed seed capsules) are added to the pan, the larger seed capsules overflow the lower edge of the rotating pan, onto vibrating feeder conveyor **132**.

The vibrating feeder conveyor feeds the seed capsules into granulator **134** (e.g. rotating drum) where the seed capsules may be



(e.g. spray) coated with inorganic fertilizer or other desired material.

From the granulator, the seed capsules flow into dryer 136 and are dried to a final product moisture of about 2-3% by weight water. The resultant product is then screened and sized as before, with undersized and oversized product seed capsules being recycled for further processing.

Urea and other liquid ~~inorganic~~ chemical fertilizers can, as indicated, be used as binders to bind together soil conditioning coatings which are not readily self-bonded together. In such embodiments, the urea or other liquid fertilizer composition serves as the binder or glue which holds together the soil conditioning material which is used as the coating. Other binding materials may be used either alone or in combination with the ~~inorganic~~ chemical fertilizer. Any plant nutrient components of the binder/glue composition contribute to the plant nutrient value, e.g. nitrogen, phosphorous, and/or potassium, provided by the so-made seed capsules. Thus, a binder/glue, or a multiplicity of binders/glues, properly selected as to nutrient value can provide, in the finished product, significant contribution to any desired fertility analysis.

A primary purpose of soil conditioning products is to condition the soil in terms of properties other than direct provision of plant nutrients.

The primary purpose of conventional inorganic chemical fertilizer products is to directly provide plant nutrients. It is well known that highly purified forms of inorganic chemical materials are more concentrated than desired in close or intimate proximity with seed, in the growing medium. Thus, inorganic chemical fertilizers can be diluted in concentration and still have sufficient nutrient content to be highly useful additives in soil conditioning seed capsules of the invention. It is common practice

to modify and thus dilute inorganic chemical fertilizer products with filler materials that do not provide plant nutrients, in order to provide less concentrated fertilizer products. To the inventor's knowledge, such diluents, however, do not include soil conditioning products, especially not organic soil conditioning products.

It is conventionally known to apply commercially available soil conditioning materials and inorganic fertilizers, in separate applications, to a given common plot of soil to assist the soil in growing a crop. For example, it is known to make a first broadcast or other placement of lime to control pH of the soil, followed by a second broadcast and/or row-applied placement of granular inorganic chemical fertilizer. It is also known to make sequential applications of a soil conditioning material such as fresh or aged manure followed by inorganic fertilizer, all of which may be separate from the step of applying seed. And where seed is indeed applied in the same step, the seed and soil conditioner are not intimately bound in controlled positioning with respect to each other in common in individual particles of the product so applied, as in the invention.

To the inventor's knowledge, it is not known to apply soil conditioning material and inorganic chemical fertilizer in a common carrier/particle. Nor is it known to apply seed in a seed capsule wherein the seed is intimately combined with a soil conditioning material in a common particle, optionally with an inorganic fertilizer component in controlled positioning with respect to the seed in the same capsule as a seed-soil conditioning particle.

In those embodiments of the invention comprehending both soil conditioning and inorganic fertilizer in the same seed capsule/particle, the ratio of soil conditioning material to inorganic chemical fertilizer material can vary, from, for example, about 80% by weight up to less than 100% by weight soil conditioning material, with corresponding greater than 0% up to

about 20% by weight inorganic chemical fertilizer. Generally, the invention as practically applied, however, is somewhat more narrowly defined, because the practical benefits of the invention are achieved at more balanced combinations of the soil conditioning material and the inorganic chemical fertilizer.

Thus, a preferred amount of soil conditioning material is about 90% by weight to about 98% by weight soil conditioning material, in combination with about 2% by weight to about 10% by weight inorganic chemical fertilizer. To the extent the soil conditioning material is present in amount less than about 80% by weight, the corresponding 20% by weight organic fertilizer in such close and intimate proximity to the seed may be toxic to the seed. To the extent the inorganic fertilizer is present in an amount of less than 2% by weight, the beneficial fertility affects of the fertilizer may not be perceived.

To the extent the inorganic fertilizer can be confined in a layer displaced from the seed, a higher level of inorganic fertilizer may be used while limiting risk of a toxic response from the seed. Referring now to FIGURES 6A-6D, in the embodiment of FIGURE 6A, seed capsule **38A** comprises a seed **40A** coated with a single generally homogeneous coating **42A**. Coating **42A**, as illustrated in FIGURE 6A, may comprise only the soil conditioning material (e.g. paper mill sludge or sewage sludge), or may comprise both the soil conditioning material and an inorganic fertilizer or other inorganic material generally dispersed in coating **42A**.

In FIGURE 6B, seed capsule **38B** comprises a seed **40B** coated with a first layer **42B** of soil conditioning material. A second coating material is shown penetrated part-way through the first layer **42B**, thus to make a combination outer layer **44B** comprising the combination of the material of layer **42A** and the material of the second material, such as inorganic fertilizer.

In FIGURE 6C, seed capsule **38C** comprises a seed **40C** coated with a first layer **42C** of soil conditioning material. A second

generally separate and distinct layer **46C** of a second coating material (e.g. inorganic fertilizer) is disposed outwardly on the underlying first layer **42C**. Layer **46C** generally does not penetrate layer **42C**, whereby higher levels of inorganic fertilizer may be used because of the effective displacement distance between the seed and the second layer **46C**. The second layer may be prevented from penetrating the first layer by applying e.g. an intervening layer which repels the second layer, for example wax, lignin, or the like.

In FIGURE 6D, seed capsule **38D** comprises a seed **40D** coated with a pre-coating layer **48D** of dicalcium phosphate to densify and configure the seed capsule precursor for the primary coating steps in drum **10** or pan pellitizer **118**. Layer **42D** of soil conditioning material is disposed outwardly of pre-coating layer **48D**. Other materials such as at layers **44B** or **46C** can be added to any of the embodiments, including that of FIGURE 6D to provide the properties associated therewith.

In alternative embodiments, seed capsules can comprise a seed coated with at least one heterogenous layer. The heterogenous layer comprises at least two different materials substantially commingled, uniformly or non-uniformly, within a single layer. Such materials can include, for example, soil conditioning material and inorganic fertilizer, ~~micro~~ micronutrients, herbicides, fungicides, binders and/or any other layer material contemplated by the present invention.

While the soil conditioning material/sewage sludge or paper mill sludge may contain a nominal amount of nitrogen and lesser quantities of phosphorous, potassium, and micronutrients, these small levels of plant nutrient content are generally not high enough for the plant nutrients to be considered a primary commercial asset. Yet only small nutrient amounts are desired so close to the seed. Thus, in some uses, the nutrient content of the sludge may be fully acceptable as the sole coating material on the

seed in making suitable and acceptable seed capsules of the invention.

5 Products of the invention offer a new combination of properties, namely readily available excellent soil conditioning properties in combination with the seed in a seed capsule wherein size and density of the seed capsule are controlled to the desired size and weight.

10 One of the properties offered by soil texture conditioners such as sewage sludge and paper mill sludge is that of maintaining soil condition by retaining moisture in the soil, retarding leaching of soil nutrients from the root zone, and attenuating hardening, clumping, or other hard agglomeration characteristics of the soil, which harder soils are more difficult for plant roots to penetrate than are softer soils. Thus, improving the soil texture condition, soil tilth, increases the efficiency with which plant nutrients are retained and used for plant nutrition, as well as generally improving the environment of the soil to accommodate, and readily receive, root growth.

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30 When soil conditioning materials and plant nutrients are applied separately to the soil, as in the prior art, the ratio of applied plant nutrients to applied soil conditioning material typically varies widely according to variations in the uniformity of the two applications of the two materials. Further, the soil conditioning material is generally not closely associated with the plant nutrient-containing fertilizer in the soil, and certainly neither soil conditioner nor the fertilizer are controllably-closely associated with the seed, such that nutrient absorption benefits provided by the soil conditioning material are not assuredly associated with respective particles of inorganic chemical fertilizer materials, and neither the soil conditioning material nor the inorganic fertilizer is controllably and intimately associated with the seed as in a common capsule or other particle as in the invention.

5 Rather, where soil conditioning and fertilizer materials are applied in separate applications and/or in applications separate from the application of the seed, the bulk of the soil conditioning material and the bulk of the inorganic chemical fertilizer are generally at least somewhat separated from each other in space, and physically separated from the seeds, such that potential cooperative benefit of the soil conditioning material as relates to solvation and up-take of soil moisture and/or of the inorganic chemical fertilizer by the seed are not obtained, and/or are not obtained in controlled close association with the seed.

10 When the soil conditioning material, the inorganic chemical fertilizer materials, and the seed are separately applied to soil with different sets of equipment, the respective rates of application vary such that the desired ratios between the quantities of the several materials are applied somewhat non-uniformly. The variances from uniformity will be different for each of the applications, thus adversely skewing the relative ratios of the materials with respect to each other at different locations in the e.g. field. Further, when applied separately to the soil, the seed and the soil conditioner are not necessarily in intimate contact with each other as they are when both materials are combined into a single combined seed capsule product as in the invention. Nor is the seed in closely controlled proximity (e.g. within the same capsule) with the inorganic fertilizer. In reality, then, any fertilizer added to the soil but not in close proximity to the seed applied to the same soil during e.g. the same growing season, is of reduced value or no value to that application of seed, whereby little or no value is realized, during that growing season, from the application of such material to the soil.

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30 The amounts of soil conditioning material and inorganic fertilizer added to the soil at any given time represent a small fraction of the "soil" in the plant growing zone (root zone). Thus, in the conventional practice of providing separate

applications of plant nutrients and soil conditioning material, in addition to the seed, only small fractions of the newly applied soil conditioning material and plant nutrient come into proximate cooperating relationship with each other and with the seed. Thus, the seed and any plant newly emergent from the seed are benefitted only to the extent the overall average root zone of the soil is benefitted by the applied soil conditioning material

Even were combinations of soil conditioner, inorganic chemical fertilizer, and seed are to be applied as separate and distinct physical product particles, using a single application apparatus and a single application process, the individual particles of soil conditioner, individual particles of inorganic chemical fertilizer, and individual particles of seed would be separated from each other to a significant degree, during the application process, such that the benefits of intimate association with each other in the soil would be lost. Indeed, the seed benefits from intimate contact with a substantial quantity of soil conditioner, but can tolerate intimate contact with only limited concentrations of fertilizer chemicals. Rather, fertilizer chemicals should in general be displaced from, but controllably located close to the seed.

In an uncontrolled application of fertilizer by an application separate from application of the seed, as in the prior art, some of the seed might be expected to be placed so close to some of the inorganic fertilizer as to be damaged by the toxic affect of such close association. Thus, the benefit of intimate contact between organic soil conditioning material, inorganic chemical fertilizer, and seed, is reduced and largely lost because of low levels of intimate association between the soil conditioning material and the seed, and unpredictable, uncontrolled levels of association between the seed and the inorganic chemical fertilizer, outside the combination of the invention, of soil conditioning coating of the seed, and optional addition of inorganic fertilizer at controlled

location with respect to the seed, all in the same seed capsule, as taught herein.

By combining an organic soil conditioning material in the same seed capsule with the seed, highly effective levels of soil conditioner are assuredly associated with the seed as the seed germinates and begins to grow. Where suitable levels of plant nutrient fertilizer are incorporated into the same seed capsule, growth of the newly-germinated plant is further enhanced. In either case, the soil conditioning materials can and do tend to retain moisture and nutrients in the soil in the defined area of the seed capsule by a variety of mechanisms, providing an extended time period during which nutrients can be taken up by the plants. For example, organic soil conditioning material may retain moisture, reducing moisture drainage from the soil, such that the rate of leaching of the nutrients is, in general, reduced. Further, the soil conditioning material may absorb or otherwise physically or chemically attach to plant nutrient materials in the chemical fertilizer material, thus further retarding leaching of the plant nutrient away from the seed.

While applicant cannot place an exact time period on the increase in the extent to which the soil conditioning materials retard leaching of the plant nutrients from proximity with the seed, thereby holding the plant nutrients available for up-take by the plant, any increase in time during which the nutrients are held in the soil proximate the newly-emerging plant is beneficial to meeting the nutritional needs of the plant being so fed.

By incorporating soil conditioning materials and optionally plant nutrient fertilizers, in the seed capsules, the invention offers an efficiency of application of soil conditioning materials in proximity to the seeds most beneficially affected thereby, in a beneficial association never before available. Optional addition of plant nutrients to the same seed capsule provides a largely self-contained microcosm of seed, soil conditioner, and inorganic

fertilizer in intimate yet controlled spatial relationship with each other, whereby the controlled spacings provide enhanced plant growth benefit. Namely, soil conditioning materials and plant nutrients are somewhat beneficial to each other for the overall cooperative achievement of soil fertility in the presence of the newly emerging plant which is dependent on such plant nutrients, and on moisture retained by the soil conditioner for uptake of such plant nutrients.

While soil conditioning materials do perform a number of highly interdependent tasks, one such task is in assisting in maintaining the plant nutrients in the root zone where they can be effectively used by the plants when needed. Another such task is in assisting in making the soil soft and friable in the root zone whereby the newly-emerged and very tender plant roots more readily penetrate the soil as they grow.

Where both soil conditioner and fertilizer are incorporated with the seed into the seed capsule, the soil conditioner assists in strategically maintaining the combination of soil conditioner and plant nutrients in close and controlled proximity to each other and to the seed in the soil. Such strategic placement virtually assures that the soil conditioning material and inorganic chemical fertilizer are bound to each other, in proximate relationship with the seed, for a time, such that wherever the seed capsule may land when the seed is sown, the seed will have the initial benefit of both soil conditioner and plant nutrients in intimate proximity with itself, irrespective of any condition of the surrounding growth medium. Thus, in the invention, soil conditioning material and optionally inorganic chemical fertilizer, are inherently bound to each other, and to the seed, as by the coating process, and inherently assist the seed in achieving desired germination and strong early growth.

By incorporating the soil conditioning material in the same seed capsule with the seed, the invention ensures that the seed has

benefit of intimate relationship with a beneficial amount of soil conditioner material. The seed thus receives the advantage of the beneficial amount of soil conditioner material irrespective of the overall tilth of the soil and irrespective of the overall level
5 soil conditioner, e.g. soil texture conditioner, in the root zone of the soil with which the seed capsule becomes associated for seed and plant growth purposes.

Referring to FIGURE 7, a population of seed capsules **38** are disposed at the top surface of a cross section of soil. Root zone
10 **150** of the soil is generally defined to that depth of the soil which typically receives roots of growing plants, and is generally defined within 20-30 inches of the top surface of the soil. Generally, and preferably, the root zone should have a soft texture, rich in organic and/or other soil conditioning material in order to provide good tilth, and desirable moisture and nutrient holding properties. Underlying root zone **150** is subsoil **152** which typically contains little organic matter.

It is a well known agricultural phenomenon that, in soil used for intensive crop production, the root zone tends, over time, to become relatively depleted of organic soil conditioning material, illustrated at **154** in FIGURE 7, negatively affecting soil tilth and texture. While wholesale addition of organic soil conditioning material can improve the overall tilth of the soil, FIGURE 7 illustrates application of the invention wherein the texture of the
20 material immediately adjacent the seed, namely coating **42**, provides beneficial properties attributable to soil having desirable texture.

FIGURE 8 illustrates that coating **42** draws moisture **154** from the soil, into the capsule, where the moisture is available to assist in germination of seed **40**. In the process, traverse of the
30 moisture through second coating **46C** releases plant nutrient material into the moisture, as well as downwardly into the soil adjacent the seed capsule, as illustrated at **156**. Thus, the root

158 emerging from the seed emerges into an initial growth medium, coating 42, having texture, moisture, and plant nutrient highly advantageous to early plant growth. As root 158 advances further downward, the upper portion of the underlying soil under the capsule where the seed first enters the soil, has also been beneficially affected to the good of the plant by plant nutrients 156, and by moisture attracted or held in the vicinity of the capsule, as a result of the presence of the soil conditioning material in the capsule.

The relative amounts of the soil conditioning material and the inorganic chemical fertilizer material in the seed capsule vary significantly in accord with the specific application, and any specific interactivity desired of the soil conditioning material and inorganic chemical fertilizer. For example, in a particular combination of soil conditioning material and inorganic fertilizer a particular plant crop to be nourished by the product may require a higher amount of plant nutrient, or a specific analysis of plant nutrients, in order to be properly fed at and shortly after the stage of germination.

Thus, for a given specific application of combination seed capsule (with fertilizer) product of the invention, the relative amount of inorganic chemical fertilizer, and the fertilizer analysis, may be increased or decreased from some "standard" in the interest of achieving a functionally adequate feeding of the newly germinated seedlings. Namely, the NPK etc. nutrient levels provided in a given seed capsule product of the invention can be set and controlled at the fertilizer manufacturing plant in accord with the respective NPK etc. nutrient needs of the seed to be supported, or of the soil or other growth medium to which the combination fertilizer of the invention is to be applied.

In any embodiments, whether or not specifically discussed here, the fabricated seed capsules are kept sufficiently cool, and are kept sufficiently dry, to avoid the seed capsules sticking to

each other, caking, and the like, and to prevent premature germination of the seed. Where liquid is used to obtain the coating material in liquid state, sufficient liquid is removed during or shortly after the coating step to avoid the seed capsules sticking to each other, or caking, or the like. Where the seed capsules are made by process other than the process described here, the details of the process will determine proper cooling, drying, or other steps to provide a finished, dry, solid seed capsule or like product. A dry such product generally has moisture content less than 10% by weight, preferably less than 5% by weight, most preferably less than 3% by weight.

As suggested by the description hereinabove, the processes of the invention are generally carried out to make combination seed improvement products solely by using physical processes such as coating and drying. While some minor chemical reactions may inadvertently accompany such physical processes, the invention does not rely on any chemical reaction for achievement of the objectives thereof. Rather the invention is focused on a physical combination of starting materials, which physical combination results in mutual benefits of the two starting materials (seed and soil conditioner, and optional inorganic chemical fertilizer) functioning intimately together, in primarily physical and physico-chemical relationship, to produce an overall increase in benefits of plant germination and early plant growth with such combination seed improvement products.

The relative amounts of seed and coating material depend on the overall benefits desired to be achieved from the coating operations. In general, the seed will comprise from about 0.1% to about 75% of the overall weight of the seed capsule. the coating material thus represents about 25% to about 99.9% by weight of the seed capsule. Where the seed content is low, the general benefit of the product is that of soil conditioning, with some seed application. Such product is well suited for application to e.g.

a healthy lawn for general improvement of soil condition, and modest fill-in of bare spots with seed.

Another benefit of low seed content by weight, especially with quite small seeds, is in creating a larger size seed capsule, and thereby facilitating the handling of such seed in commonly-used seed handling machines such as grain drills or seed broadcast machines.

Typically, however, a higher seed content is preferred so as to have major impact on the number of plants which are caused to germinate by application of such product. Thus, for a seed about 0.5-1.0 mm thick and about 4-7 mm long, a preferred fraction of seed is about 1% to about 50%, preferably about 1.5% to about 20%, more preferably about 2% to about 10% by weight seed, with respective amount of soil conditioner and optionally fertilizer. For example, in a preferred product of the invention, an above mentioned grass seed about 0.5-1.0 mm thick and about 4-7 mm long, when coated produces a seed capsule about 4 mm across and about 6-9 mm long. Smaller, or larger, seed capsules may be made and used as desired.

The size and density of the seed capsules can be readily controlled using conventional sizing equipment and processing parameters of the coating process, so as to provide a uniform product of a wide range of sizes and densities. With the size and density of any seed thus controllable, the size and density may be selected and specified for enhancing control and efficiency of seed handling and/or distribution. For example, tiny seeds such as lettuce, carrots, cabbage, and alfalfa, may be sized and weighted for easy and assured handling and distribution, whether by hand or by machine. Seeds which are non-aerodynamic, or which are so light as to be blown around, such as grass seed, can be made heavy and compact enough as to assuredly remain on location where sown after being planted. For example, non-aerodynamic seeds, after treatment according to the invention, can be broadcast-applied using

conventional equipment such as is used to broadcast apply granular fertilizer over e.g. 40 foot wide application paths.

5 Where time controlled germination is desirable, a population of combination seed capsules, having at least one soil conditioner and one or more nutrients, can be planted in conjunction with non-coated seeds. As a result, non-coated seeds will germinate at an earlier stage than the population of combination seed capsules. Such staggering of germination times allows, for example, the non-coated seeds to use the available soil nutrients with less competition (i.e. less seeds using limited nutrient supply). At a later time, when the coated seeds germinate, such seeds can use the nutrients leached from their combination seed capsules to germinate.

10 Where e.g. small such seeds are desirably planted in close proximity with each other, and wherein a relatively larger size seed capsule is desired for ease of handling such that the large size seed capsule would potentially interfere with such close placement of the seeds with respect to each other, then and in such situation, multiple seeds may be employed in individual seed capsules, e.g. generally uniformly distributed throughout the seed capsule, so as to provide for sufficiently close spacing of the seeds from each other.

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25 Paper mill sludge, as is suggested as a coating material herein, is a resultant by-product of papermaking, typically from e.g. a de-inking process in the paper mill.

By utilizing paper mill sludge and/or sewage sludge as taught herein, one contemplates beneficially and suitably disposing of significant quantities of industrial waste which otherwise is disposed of by landfilling.

30 Where the product of the invention is applied as to a residential or like lawn, as in an agricultural field, the seed is applied to the soil in intimate combination (seed capsule) with the soil conditioner, such that the soil conditioner serves as moisture

retainer and sun shield. In addition, the seed capsule is much heavier and dense than the seed itself, whereby the seed capsule provides substantial protection against the seed being washed away in surface water run-off. Thus, the coating about the seed serves many of the functions typically performed by the conventionally-used straw mulch. Accordingly, product of the invention can be used to seed new lawns without any need for use of straw or any other mulch material.

Where seed is desirably used to fill in bare spots in the lawn, such seed, especially fertility-enhanced seed capsules, may be applied desirably in one of two ways. First, the coated seed capsule product may be applied only to perceived bare spots, without use of straw. The soil conditioner in the seed capsules serve the functions of the straw as described above, but perform better than straw because of the close association between the seed and the soil conditioner.

In the alternative, the coated seed capsule product may be broadcast generally over the entire lawn. Where the lawn is already healthy with thick grass growth, the soil conditioner and fertilizer will benefit the existing grasses, with minimal germination and growth of new seed from the seed capsules. Where the existing grass is thinner, the seeds in the seed capsules will have room and light to grow, whereby the combined properties of seed, soil conditioner, and fertilizer, in intimate relationship with one another, will be efficaciously used.

Where seed capsules of the invention are used to establish a new lawn, the soil conditioner in the seed capsules serve the functions of the straw as described above, obviating the need for straw in establishing the lawn seeding.

Those skilled in the art will now see that certain modifications can be made to the apparatus and methods herein disclosed with respect to the illustrated embodiments, without departing from the spirit of the instant invention. And while the

CLAIMS

Having thus described the invention, what is claimed is:

1. A combination seed capsule, comprising:
- (a) at least one viable seed, having an outer surface and acting as a core or psuedo-core of said combination seed capsule; and
 - (b) a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed.
2. A combination seed capsule as in Claim 1, said coating providing at least one of
- (i) enhancing broadcast flight properties of said combination seed capsule;
 - (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
 - (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;
 - (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;

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- (v) enhancing control of moisture about said seed thereby to assist in seed germination;
- (vi) release of plant nutrients into soil onto which said combination seed capsule is placed;
- (vii) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released;
- (ix) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density; and
- (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

3. A combination seed capsule as in Claim 1 wherein said seed is selected from the group consisting of grass, vegetables, grains, and flowers.

4. A combination seed capsule as in Claim 1, said coating further comprising said soil conditioning material in combination with at least one ingredient effective to reduce susceptibility of

said seed capsule to deleterious affect of at least one of animals, weeds, and spore-formers.

5. A combination seed capsule as in Claim 4 wherein said at least one ingredient to reduce susceptibility of the seed capsule is selected from the group consisting of herbicides, fungicides, and a bitter substance.

6. A combination seed capsule as in Claim 5 wherein said fungicide comprises metalaxyl.

7. A combination seed capsule as in Claim 1, said coating comprising a first coating, said combination seed capsule further comprising a second coating, separate from said first coating, and comprising at least one ingredient effective to reduce susceptibility of said seed capsule to deleterious effect of at least one of animals, weeds, and spore-formers.

8. A combination seed capsule as in Claim 1, effective to provide a plant nutrient at a desirable controlled distance from a plant seedling emerging from said seed, in an amount beneficial to said plant seedling.

9. A combination seed capsule as in Claim 1, said coating comprising a first coating, said combination seed capsule further comprising a second coating of a second coating material intermingled with said first coating material in an outer portion of said first coating, and generally displaced from said seed.

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10. A combination seed capsule as in Claim 9 wherein said second coating material comprises a plant nutrient, beneficial in location and in amount of availability, to plant seedling emerging from said seed.

11. A combination seed capsule as in Claim 9 wherein said second coating composition comprises an inorganic form of a plant nutrient and is selected from the group consisting of nitrogen, phosphorus, and potassium.

12. A combination seed capsule as in Claim 9 wherein said second coating composition comprises an inorganic form of a plant nutrient and is selected from the group consisting of urea, monammonium phosphate, diammonium phosphate, superphosphate, triple superphosphate, dicalcium phosphate, and potash.

13. A combination seed capsule as in Claim 9 wherein said second coating composition comprises an inorganic form of a plant nutrient is selected from the group consisting of sulfur, manganese, copper, boron, iron, magnesium and chromium.

14. A population of combination seed capsules of Claim 1, said population of seed capsules comprising coatings having a range of properties affecting germination rate of said seeds, thereby to stage germination of said seeds in said population over a period of time longer than the range of germination times inherent in uncoated ones of said seeds.

15. A population of combination seed capsules as in Claim 14 wherein said range of properties comprises at least one of (i) a range of hardnesses and (ii) a range of thicknesses, of said coatings.

16. A combination seed capsule as in Claim 1, said coating comprising a first layer of said soil conditioning material, and including a second layer comprising an inorganic fertilizer.

17. A combination seed capsule as in Claim 1, said coating comprising a first layer of said soil conditioning material, and including a second layer comprising at least one micronutrient.

18. A combination seed capsule as in Claim 17 wherein said micronutrient is selected from the group consisting of sulfur, manganese, copper, boron, iron, magnesium and chromium.

19. A combination seed capsule as in Claim 1, said soil conditioning material comprising a sludge composition.

20. A combination seed capsule as in Claim 1, said soil conditioning material comprising a fiber-containing by-product of a paper making operation.

21. A combination seed capsule as in Claim 1, said seed capsule comprising a water-leachable plant nutrient, and a leach-

retardant composition effective to retard leaching of said leachable plant nutrient out of said combination seed capsule.

22. A population of combination seed capsules of Claim 1, said coating in ones, but less than all, of said population, comprising an ingredient effective to retard effective penetration of a seed-germinating environment to said seed for germination thereof.

23. A combination seed capsule as in Claim 1, said seed capsule comprising an inner layer on the outer surface of said seed, and an outer layer, said inner layer enhancing properties of said seed for acting as nucleus in an agglomeration operation agglomerating said coating onto said inner layer.

24. A combination seed capsule as in Claim 1 wherein said coating comprises an admixture of said soil conditioner and a plant nutrient.

25. A combination seed capsule as in Claim 1 wherein said coating remains generally disposed about said seed until said seed germinates.

26. A plant growing system, comprising:

- (a) a plant growing medium extending over an area, said plant growing medium having a root zone, and a top surface of said root zone generally corresponding with a top surface

of said plant growing medium, said plant growing medium having a first overall soil condition and texture; and

- (b) a population of seed capsules disposed over the top surface of said plant growing medium, said seed capsules comprising individual seeds, having outer surfaces, and coatings of soil conditioning material disposed outwardly of the outer surfaces of said seeds,

said coatings of said seed capsules providing localized germination and growth environments, at and adjacent said seeds, having texture, and nutrient and water holding properties for supporting seedling health, superior to respective said properties as provided overall in the root zone of said plant growing medium.

27. A growing system as in Claim 26, said coatings remaining generally disposed about said seeds until respective ones of said seeds germinate.

28. A growing system as in Claim 26, said coatings providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;

- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;
- (v) enhancing control of moisture about said seed thereby to assist in seed germination;
- (vi) release of plant nutrients into soil onto which said combination seed capsule is placed;
- (vii) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released;
- (ix) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density; and
- (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

29. A growing system as in Claim 26 wherein said seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

30. A growing system as in Claim 26, said coatings further comprising said soil conditioning material in combination with at least one ingredient effective to reduce susceptibility of said seed capsules to deleterious affect of at least one of animals, weeds, and spore-formers.

31. A growing system as in Claim 26, said coating comprising a first coating, said combination seed capsules further comprising a second coating, separate from said first coating, and comprising at least one ingredient effective to reduce susceptibility of said seed capsules to deleterious effect of at least one of animals, weeds, and spore-formers.

32. A growing system as in Claim 26, effective to provide plant nutrients at desirable controlled distances from plant seedlings emerging from said seeds, in amounts beneficial to said plant seedlings.

33. A growing system as in Claim 26, said coatings comprising first coatings, said combination seed capsules further comprising second coatings of second coating materials intermingled with said first coating materials in outer portions of said first coatings, and generally displaced from said seeds.

34. A growing system as in Claim 33 wherein said second coating materials comprise plant nutrients, beneficial in location and in amount of availability, to plant seedlings emerging from said seeds.

35. A growing system as in Claim 26, said population of seed capsules comprising coatings having a range of properties affecting germination rates of said seeds, thereby to stage germination of said seeds in said population over a period of time longer than the range of germination times inherent in uncoated ones of said seeds.

36. A growing system as in Claim 26, said coatings comprising first layers of said soil conditioning material, and including second layers comprising inorganic fertilizer.

37. A growing system as in Claim 26, said soil conditioning material comprising a sludge composition.

38. A growing system as in Claim 26, said soil conditioning material comprising a fiber-containing by-product of a paper making operation.

39. A growing system as in Claim 26, said seed capsules comprising inner layers on the outer surfaces of said seeds, said inner layers enhancing properties of said seeds for acting as nucleus in an agglomeration operation agglomerating said coatings onto said inner layers.

40. A growing system as in Claim 26 wherein said coatings comprise admixtures of said soil conditioner and plant nutrient.

41. A method of providing plant micronutrients to soil, the method comprising placing onto the soil a population of combination seed capsules, each comprising at least one seed, and a coating comprising a plant micronutrient material.

42. A method as in Claim 41, the coating comprising a first coating comprising the plant micronutrient, and a second coating, separate and distinct from the first coating, and comprising a soil conditioning material.

43. A method as in Claim 41, the coating providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;
- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;
- (v) enhancing control of moisture about said seed thereby to assist in seed germination;
- (vi) release of plant nutrients into soil onto which said combination seed capsule is placed;

- (vii) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (viii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released;
- (ix) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density; and
- (x) assisting in stabilizing moisture content in soil on which such seed capsule is disposed.

44. A method as in Claim 41, the coating providing a plant nutrient at a desirable controlled distance from a plant seedling emerging from the seed, in an amount beneficial to the plant seedling.

45. A method as in Claim 41, the coating comprising a first coating, the combination seed capsule further comprising a second coating of a second coating material intermingled with the first coating material in an outer portion of the first coating, and generally displaced from the seed.

46. A method as in Claim 45 wherein the first coating comprises plant micronutrient material and the second coating

comprises plant nutrient material comprising at least one of nitrogen, phosphorus, and potassium.

47. A method as in Claim 41 wherein the micronutrient composition comprises a plant nutrient selected from the group consisting of sulfur, manganese, copper, boron, iron, magnesium and chromium.

48. A method as in Claim 41, the coating comprising a first layer of the soil conditioning material, and including a second layer comprising an inorganic fertilizer.

49. A method as in Claim 41, the coating comprising a sludge composition.

50. A method as in Claim 41, the coating comprising a fiber-containing by-product of a paper making operation.

51. A method as in Claim 41, the seed capsule comprising an inner layer on an outer surface of the seed, and an outer layer, the inner layer enhancing properties of the seed for acting as nucleus in an agglomeration operation agglomerating the coating onto the inner layer.

52. A method as in Claim 41 wherein the coating comprising an admixture of soil conditioner and a plant nutrient.

53. A method as in Claim 41 wherein the coating remains generally disposed about the seed until the seed germinates.

54. A method of providing a seed bed having enhanced growing conditions for growing seed, the method comprising:

- (a) coating a population of the seeds with material, and thereby providing coatings thereon of such material, tending to stabilize, in the seed capsules, or in soil on which the seed capsules are disposed coating compositions which tend to hold, moisture adjacent the seeds in the seed capsules or in soil adjacent the seed capsules, in such quantities and for such times as to enhance growing conditions for the seeds; and
- (b) placing the population of seeds on soil effective to support germination of the seeds which are in the seed capsules.

55. A method as in Claim 54, the coatings providing at least one of

- (i) enhancing broadcast flight properties of said combination seed capsule;
- (ii) reducing susceptibility to deleterious affects of weather on said combination seed capsule;
- (iii) enhancing resistance of said combination seed capsule to attack by animals or spore-formers;

- (iv) staged germination of ones of said seed capsules, having seeds, under a given set of conditions, over a period of time longer than the range of germination times inherent in said seeds;
- (v) release of plant nutrients into soil onto which said combination seed capsule is placed;
- (vi) soil conditioning effect to soil onto which said combination seed capsule is placed;
- (vii) staged release of plant nutrients into soil onto which said combination seed capsule is placed, over a period of time longer than the range of times inherent in the chemical composition so released; and
- (viii) higher embryo emergence and survival rate in a population of said seed capsules, thereby reducing required seed planting density for a desired plant population density.

56. A method as in Claim 54 wherein the seeds are selected from the group consisting of grass, vegetables, grains, and flowers.

57. A method as in Claim 54, effective to provide a plant nutrient at desirable controlled distances from plant seedlings emerging from the seeds, in amounts beneficial to the plant seedlings.

58. A method as in Claim 54, the coatings comprising first coatings, the combination seed capsules further comprising second coatings of second coating materials intermingled with the first coating materials in outer portions of the first coatings, and generally displaced from the seeds.

59. A method as in Claim 58 wherein the second coating materials comprise plant nutrients, beneficial in location and in amount of availability, to plant seedlings emerging from the seeds.

60. A method as in Claim 58 wherein the second coating compositions comprise inorganic forms of plant nutrients and are selected from the group consisting of nitrogen, phosphorus, and potassium.

61. A method as in Claim 54, the population of seed capsules comprising coatings having a range of properties affecting germination rate of the seeds, thereby to stage germination of the seeds in the population over a period of time longer than the range of germination times inherent in uncoated ones of the seeds.

62. A method as in Claim 54, the coatings comprising first layers of the soil conditioning material, and including second layers comprising inorganic fertilizer.

63. A method as in Claim 54, the coatings comprising first layers of the soil conditioning materials, and including second layers comprising micronutrients.

64. A method as in Claim 54, the soil conditioning materials comprising sludge compositions.

65. A method as in Claim 54, the soil conditioning materials comprising fiber-containing by-products of paper making.

66. A method as in Claim 54, the seed capsules comprising water-leachable plant nutrients, and leach-retardant compositions effective to retard leaching of the leachable plant nutrients out of the combination seed capsules.

67. A method as in Claim 54, the seed capsules comprising inner layers on the outer surfaces of the seeds, and outer layers, the inner layers enhancing properties of the seeds for acting as nuclei in agglomeration operations agglomerating the coatings onto the inner layers.

68. A method as in Claim 54 wherein the coatings comprise admixtures of the soil conditioners and plant nutrients.

69. A method as in Claim 54 wherein the coatings remain generally disposed about the seeds until the seeds germinate.

70. A method of making a population of combination seed capsules, each comprising a seed, and a coating of a soil conditioning material, the method comprising:

- (a) pre-coating the seed with a material which enhances the ability of the seed to act as a nucleus in an agglomeration operation, to form a pre-coated substrate; and
- (b) subsequently coating the pre-coated substrate with a soil conditioning material.

71. A method as in Claim 70 wherein the pre-coating material comprises dicalcium phosphate.

72. A method as in Claim 70 wherein the pre-coating step results in an overall increase in the density of pre-coated seed combination.

73. A method as in Claim 70 wherein the pre-coating is accomplished by spraying the pre-coating material onto the seed.

74. A method of providing an enhanced seed germination environment in combination with placement of a controlled amount of plant nutrients in controlled proximity to each seed, the method comprising:

- (a) providing a population of seeds, coated with a soil conditioning material which tends to enhance germination of the seeds, and with plant nutrient composition effective to enhance growth of plant embryos emerging from the seeds; and

(b) placing the population of seeds on soil effective to support germination of the seeds.

A

75. A method as in Claim 74 wherein the coating material includes therein a second ingredient comprising plant nutrient moieties.

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ABSTRACT OF THE DISCLOSURE

This invention pertains to combination seed capsules wherein each seed capsule includes both moieties of at least one soil conditioner and at least one seed, and optionally, one or more inorganic chemical fertilizer, growth enhancer, binder, and/or anti-fungal agent. The combination seed capsules are made by physically combining the respective soil conditioner and seed with one other, in the absence of any requirement for chemical reactions in the process of so combining the respective materials. The combination seed capsules provide cooperative and beneficial effects of the soil conditioner and the optional inorganic fertilizer, working together in controlled intimate relation with the seed, to enhance the germination and growth processes of the seed, and the plant emergent therefrom, greater than when the soil conditioner and seed, and optionally inorganic chemical fertilizer, are applied to the soil separately; the improvement being a result of the intimate relationship of the respective materials in the combination seed capsule, whereby the respective materials cooperate with each other in support of germination and plant growth.



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Bib Data Sheet

SERIAL NUMBER 09/113,254	FILING DATE 07/10/1998 RULE -	CLASS 047	GROUP ART UNIT 1649	ATTORNEY DOCKET NO. 29214
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APPLICANTS
 DANIEL PAUL MADIGAN, GREEN BAY, WI ;
 MICHAEL DENNIS KRYSIAK, GREEN BAY, WI ;
 RONALD DEAN EICHHORN, GREEN BAY, WI ;
 GLEN H. WESENBERG, GREEN BAY, WI ;

**** CONTINUING DATA *******
 THIS APPLN CLAIMS BENEFIT OF 60/052,287 07/11/1997

**** FOREIGN APPLICATIONS *******

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 07/28/1998

Foreign Priority claimed 35 USC 119 (a-d) conditions met	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> Met after Allowance	STATE OR COUNTRY WI	SHEETS DRAWING 6	TOTAL CLAIMS 75	INDEPENDENT CLAIMS 5
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Verified and Acknowledged
 Examiner's Signature _____ Initials _____

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TITLE
 SEEDING TREATMENTS

FILING FEE RECEIVED 1542	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	<input type="checkbox"/> All Fees
		<input type="checkbox"/> 1.16 Fees (Filing)
		<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)
		<input type="checkbox"/> 1.18 Fees (Issue)
		<input type="checkbox"/> Other _____
		<input type="checkbox"/> Credit

SERIAL NUMBER 09/113,254	FILING DATE 07/10/98	CLASS 047	GROUP ART UNIT 1649 1661	ATTORNEY DOCKET NO. 29214
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APPLICANT DANIEL PAUL MADIGAN, GREEN BAY, WI; MICHAEL DENNIS KRYSIAK, GREEN BAY, WI; RONALD DEAN EICHHORN, GREEN BAY, WI; GLEN H. WESENBERG, GREEN BAY, WI.

****CONTINUING DOMESTIC DATA*******
 VERIFIED
Amc

****371 (NAT'L STAGE) DATA*******
 VERIFIED
Amc

****FOREIGN APPLICATIONS*******
 VERIFIED
Amc

Amc

I. REQUIRED, FOREIGN FILING LICENSE GRANTED 07/28/98

Foreign Priority claimed 35 USC 119 (a-d) conditions met	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> yes <input checked="" type="checkbox"/> no	<input type="checkbox"/> Met after Allowance	STATE OR COUNTRY WI	SHEETS DRAWING 6	TOTAL CLAIMS 75	INDEPENDENT CLAIMS 5
Verified and Acknowledged <u>Amc</u>		Examiner's Initials _____	Initials _____			

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TITLE SEEDING TREATMENTS

FILING FEE RECEIVED \$1,147	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT NO. _____ for the following: P. 314	<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ UT Ex. 2025 <input type="checkbox"/> Credit
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Seed Med v. United Therapeutics



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NOTICE OF FILING/CLAIM FEE(S) DUE
 TO ENSURE PROPER CREDIT OF FEES, PLEASE RETURN A COPY OF THIS
 FEE CALCULATION SHEET WITH YOUR RESPONSE.

APPLICATION NUMBER: 113 254

Total Fee Calculation

Fee Code	Total # Claims	Number Extra	X	Fee		Total
				Sm. Entity	Lg. Entity	
Basic Filing Fee	<u>201/101</u>					<u>790</u>
Total Claims >20	<u>203/103</u>	<u>75</u> -20 = <u>55</u>	X			<u>1210</u>
Independent Claims >3	<u>202/102</u>	<u>5</u> -3 = <u>2</u>	X			<u>164</u>
Multi. Dep Claim Present	<u>204/104</u>					
Surcharge	<u>205/105</u>					<u>130</u>
English Translation	<u>139</u>					<u>0</u>
<u>TOTAL FEE CALCULATION</u>						<u>2294</u>

Fees due upon filing the application:

Total Filing Fees Due = \$ 2294

Less Filing Fees Submitted - \$ 0

BALANCE DUE = \$ 2294

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 1997

Application or Docket Number

113254

CLAIMS AS FILED - PART I

(Column 1) (Column 2)

FOR	NUMBER FILED	NUMBER EXTRA
BASIC FEE		
TOTAL CLAIMS	75	minus 20 = * 55
INDEPENDENT CLAIMS	5	minus 3 = * 2
MULTIPLE DEPENDENT CLAIM PRESENT		

SMALL ENTITY TYPE

OR

OTHER THAN SMALL ENTITY

RATE	FEE
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x\$11=	
x41=	
+135=	
TOTAL	

OR

RATE	FEE
	790.00
x\$22=	120
x82=	164
+270=	
TOTAL	2164

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

(Column 1) (Column 2) (Column 3)

AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	=
	Total	*	Minus	**	
Independent	*	Minus	***		=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					

SMALL ENTITY

OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
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x41=	
+135=	
TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
x\$22=	
x82=	
+270=	
TOTAL ADDIT. FEE	

(Column 1) (Column 2) (Column 3)

AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	=
	Total	*	Minus	**	
Independent	*	Minus	***		=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					

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TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
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x82=	
+270=	
TOTAL ADDIT. FEE	

(Column 1) (Column 2) (Column 3)

AMENDMENT C	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	=
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Independent	*	Minus	***		=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					

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TOTAL ADDIT. FEE	

OR

RATE	ADDITIONAL FEE
x\$22=	
x82=	
+270=	
TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
 ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
 *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
 The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 2.

Received by United Therapeutics

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:
Daniel Paul Madigan et al

Group Art Unit: Unassigned

Serial Number: Unassigned

Examiner: Unassigned

Filed: July 10, 1998

For: SEEDING TREATMENTS

CORRESPONDENCE ADDRESS

Hon. Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Kindly address all correspondence regarding the above-referenced Application to the following address:

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Respectfully submitted,
Daniel Paul Madigan et al

By Thomas D. Wilhelm
Thomas D. Wilhelm
Attorney for Applicants
(Reg. No. 28,794)

July 10, 1998
Appleton, Wisconsin

47	57.6	57.6	ISSUE CLASSIFICATION
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PATENT NUMBER
6209259

U.S. UTILITY PATENT APPLICATION

3	O.I.P.E.	PATENT DATE
SCANNED	O.A.	APR 03 2000

SECTOR	CLASS	SUBCLASS	ART UNIT	EXAMINER
	47	57.6	1650 5575	Grünberg

FILED WITH: DISK (CRF) FICHE
(Attached in pocket on right inside flap)

PREPARED AND APPROVED FOR ISSUE

ISSUING CLASSIFICATION			
ORIGINAL		CROSS REFERENCE(S)	
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
47	57.6	47	58.1
INTERNATIONAL CLASSIFICATION			
A01C	1/06		
A01C	21/00		

Continued on Issue Slip Inside File Jacket

<input type="checkbox"/> TERMINAL DISCLAIMER	DRAWINGS			CLAIMS ALLOWED	
	Sheets Drwg.	Figs. Drwg.	Print Fig.	Total Claims	Print Claim for O.G.
	6	118	NA	14	1
<input type="checkbox"/> a) The term of this patent subsequent to _____ (date) has been disclaimed.	Anne Marie Grünberg 9/13/00 (Assistant Examiner) (Date)			NOTICE OF ALLOWANCE MAILED	
				9/26/00	
<input type="checkbox"/> b) The term of this patent shall not extend beyond the expiration date of U.S. Patent. No. _____	BRUCE R. CAMPELL, PH.D. SUPERVISORY PATENT EXAMINER TECHNOLOGY CENTER 1600			ISSUE FEE	
	Bruce Campell 7/15/00 (Primary Examiner) (Date)			Amount Due	Date Paid/Rub
			\$1210	12-21-00	
<input type="checkbox"/> c) The terminal _____ months of this patent have been disclaimed.	9/29/00 (Date)			ISSUE BATCH NUMBER	
				582	

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SEARCHED

Class	Sub.	Date	Exmr.
47	65 65.5 74 57.6 58.1	6/12/99	Amr
updated search 5/3/00			Amr
47 1	57.6 58.1	9/11/00	Amr

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
47 1	57.6 58.1	9/11/00	Amr

SEARCH NOTES (INCLUDING SEARCH STRATEGY)

	Date	Exmr.
BIOSIS, CABA, CAPLUS, Agricola, Derwent, GPI web of uspatents	6/1/99	Amr
S seed (10- (capsul? or encapsul? or coat?) S sludge S broadcast)		
updated search 5/3/00 Amr		
S West S seed S coat or coating or coated or agglomerate or 9:1m S dry or solid or powder or dust S fines or sludge or sand or waste	9/11/00	Amr

(RIGHT OUTSIDE)

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION			
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW		6876	7-2-91

INDEX OF CLAIMS

✓ Rejected N Non-elected
 Allowed I Interference
 - (Through numeral) Canceled A Appeal
 + Restricted O Objected

Claim	Date
Final Original	
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52	5/20/91
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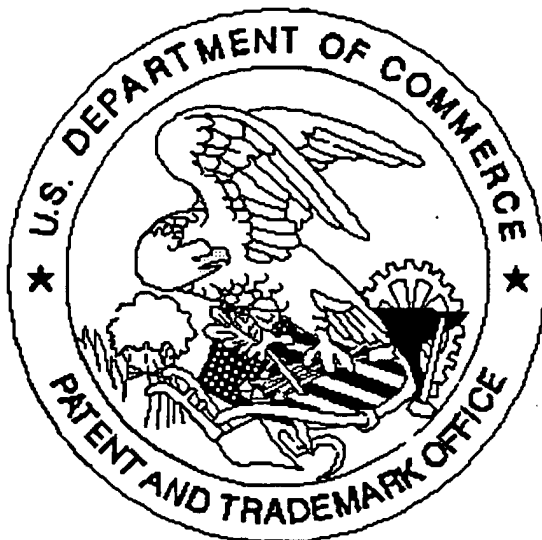
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Claim	Date
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If more than 150 claims or 10 actions
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