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METHOD OF REGENERATING MEDIA FOR USE IN PRESSURIZED DEVICE

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(56) Prior Art Documents
US 5344472
US 5146716
US 5256703

(57) Claim

1. A method of recycling a used composite blasting media after being propelled through desired blasting equipment, said composite blasting media comprising a plurality of granules which each contain a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component, which is a solid at the operating temperature,

said method comprising the steps of:

collecting the composite blasting media after at least one blasting cycle;

mixing at least one of additional abrasive component and additional carrier component with the collected composite blasting media; and

forming the mixture of composite blasting media into a plurality of granules each containing a plurality of discrete particles of the abrasive component physically interconnected with one another by the carrier component.

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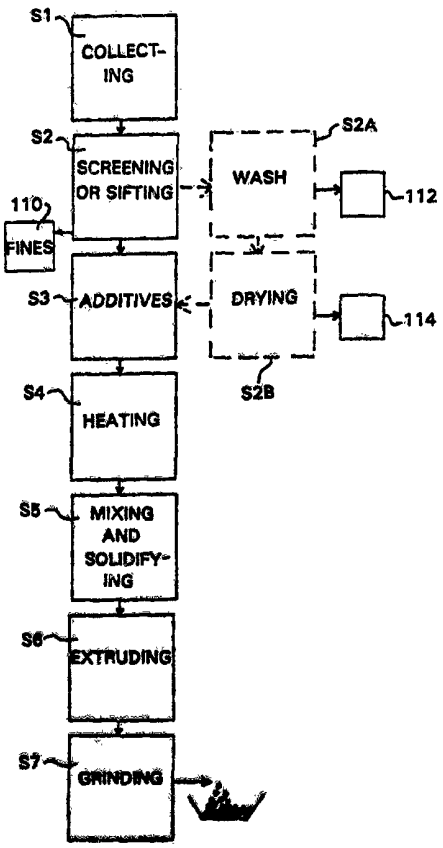
(54) Title: METHOD OF REGENERATING MEDIA FOR USE IN PRESSURIZED DEVICE

(57) Abstract

A method of recycling a reusable composite blasting media comprising a plurality of discrete particles of an abrasive component combined with a carrier component. The method comprises the steps of collecting the recyclable composite blasting media (S1) after at least one blasting cycle, screening or sifting the collected blasting media (S2) mixing an abrasive or carrier additive with the collected composite blasting media (S3) heating the mixture (S4), and forming the composite media (S6), into a plurality of granules each containing a plurality of discrete particles of the abrasive component and the carrier component.



METHOD OF REGENERATING MEDIA FOR USE IN PRESSURIZED DEVICE

This invention relates to a method of remaking and/or regenerating media, for use in suitable blasting equipment, so that such remade and/or regenerated media may be again used in suitable blasting equipment and propelled, via a pressurized air stream, against a surface of an object to dislodge and/or absorb any contaminant thereon. The contaminant or contaminants to be removed may include any foreign substance attached to or carried by the surface such as hazardous materials, soil, grease, oil, paint, soot, solvents and other objectionable deposits.

Background of the Invention

The present invention is particularly directed at remaking and/or regenerating media which is commonly referred to as "composite media" which comprises a plurality of discrete particles of an abrasive component mixed with and attached to a carrier component. The abrasive component and carrier component are selected to provide desired wear of the composite media, during use, to expose additional underlying abrasive media and to enhance cleaning of the surface being treated. The composite media facilitates feeding of the blasting media and results in deeper penetration of the blasting media into the surface being treated. A number of known blasting media compositions, which are particularly adapted for remaking and/or regenerating, are disclosed in United States Patent No. 5,234,470 issued August 10, 1993 to William R. Lynn and Wilfred P. Parent.

Summary of the Invention:

In one important embodiment of the invention, there is provided a method of recycling a used composite blasting media after being propelled through desired blasting equipment, said composite blasting media comprising a plurality of granules which each contain a plurality of discrete particles of an abrasive component

physically interconnected with one another by a carrier component, which is a solid at operating temperature,

said method comprising the steps of:

collecting the composite blasting media after at least one blasting cycle;

mixing at least one of additional abrasive component and additional carrier component with the collected composite blasting media; and

forming the mixture of composite blasting media into a plurality of granules each containing a plurality of discrete particles of the abrasive component physically interconnected with one another by the carrier component.

In the description and claiming of the present invention, wherever the word "comprising" or the word "comprises" is used the usage is in the sense that the specified features may be present in combination with further unspecified features chosen such that the specified features remain an operative combination. For example, the word "comprising" is used in the sense of "including".

In the above embodiment the reforming of the desired granules is achieved by mixing in additional abrasive material and/or additional carrier component. However, the invention extends to other embodiments, for example where reforming is achieved through suitable processing with choice of suitable materials. Thus, in a general aspect, the invention may be defined as relating to a method of forming a recyclable granulated composite blasting media for use in treating a surface to remove undesired contaminants therefrom, said composite blasting media being suitable for being propelled via a fluid stream through desired blasting equipment;

said method comprising the steps of:

forming granules of the composite blasting media, each said granule comprising a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component, which is solid at operating temperature, the carrier

component being selected to wear, during use of the composite blasting media, at a rate so as to continuously expose additional underlying abrasive particles on an exterior surface of that composite media particle, but not at a rate to allow the premature separation of the abrasive particles from an exterior surface of that composite media particle;

propelling the recyclable composite blasting media through desired blasting equipment to treated a desired surface;

collecting the composite blasting media with a collecting device and cleaning the collected composite blasting media, after at least one blasting cycle, with a cleaning device; and

reforming the composite blasting media into a plurality of granules each containing a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component.

Although important embodiments of the specification are directed to a system and a method which operates at room temperature with the carrier component solid at room temperature, the invention can be applied in a low temperature embodiment so that a carrier component such as water, which is liquid at room temperature, is a solid in practicing the invention. Thus, a further embodiment of the invention relates to a method of recycling a used composite blasting media after being propelled through desired blasting equipment, said composite blasting media comprising a plurality of granules which each contain a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component, which is solid at a temperature below room temperature,

said method comprising the following steps all occurring at a temperature below room temperature:

collecting the composite blasting media after at least one blasting cycle;

mixing at least one of additional abrasive component and additional carrier component with the collected composite blasting media; and

forming the mixture of composite blasting media into a plurality of granules each containing a plurality of discrete particles of the abrasive component physically interconnected with one another by the carrier component.

At least preferred embodiments of the invention may be considered useful to facilitate recycling, rebuilding, regenerating, recombining, reusing and/or repairing of the blasting media on site to minimize the waste associated with a blasting operation and maximize efficient use of the blasting media.

A most useful feature of some embodiments of the invention is to provide a method of collecting, screening, sifting and/or separating of the used composite blasting media from the debris and other contaminants and to clean and recycle the composite blasting media to produce new granules of the composite blasting media which each contain additional abrasive component and/or carrier component.

An advantageous embodiment of the invention is one in which carrier component is selected to be capable of physically carrying the abrasive component while controlling dust and prolonging the integrity of the abrasive component. As the composite blasting media begins to wear, the composite blasting media is recycled by adding additional abrasive component and/or carrier component to the used composite blasting media and this mixture is formed into new larger granules each containing the carrier component and the abrasive component.

The invention also has the versatility to be applied in embodiments in which a liquid or solid substance, a bacteria or a fungus is added to the composite blasting media which will assist the composite blasting media in decomposing or decompose the absorbed contaminant

and debris over a desired period of time. The substance is typically added just prior to use.

Brief Description of the Drawings:

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 diagrammatically shows a feed mechanism for supplying the blasting media to the blasting nozzle;

Figure 2 diagrammatically shows one embodiment of the method of collecting and recycling the composite blasting media; and

Figure 3 diagrammatically shows a second embodiment of the method of collecting and recycling the composite blasting media.

Description of the Preferred Embodiments

Suitable blasting equipment, for propelling blasting media against a desired surface is shown in Figure 1. As such equipment is well known in the art, it is only briefly discussed hereinafter. The improved composite media 40 is supplied to and contained within a hopper 44. An outlet of the hopper is connected with a positive feed mechanism 42 such as an auger driven by a motor 41. The auger conveys the blasting media 40 through a one way valve 43 toward a T-fitting 45. Pressurized air is supplied from air pressure source 46 to a second inlet of the T-fitting 45. The pressurized air in the conveying blasting media combined with one another and are mixed and conveyed out an outlet of the T-fitting 45 toward the nozzle 47 for a discharge against a desired surface 48.

With reference to Figures 1 through 3, the method of recycling the composite blasting media according to the present invention will now be described in detail. The regenerated composite blasting media according to the present invention is unique because the abrasive component is physically (mechanically, chemically, etc.) supported or held by the carrier component. Further, the carrier component can be selected to control the generation of dust and prolong the useful life, e.g. the integrity, etc., of the abrasive component as the carrier component can absorb much of the impact energy upon striking the surface being treated. As the media begins to wear, additional abrasive components are continually exposed. Once the carrier component has been sufficiently worn,

i.e. after the blasting media 50 has been reused through the blasting equipment a sufficient amount of times (e.g. 5-9 cycles) and discharged via the nozzle 47 against the surface 48 to be treated, the used blasting media is collected (step S1), by a suitable collection means 100. One such suitable collection means would, for example, be an operator sweeping the media particles into a pile and collecting the same with a dust pan or, preferably, using some sort of vacuum device to suck up all of the blasting media particles 50. Once the media particles are collected (Figs. 2 and 3), they can be either screened or sifted (step S2) to separate the small particles, fines and other contaminates and debris 110 from the recyclable composite blasting media. If desired, the screening step can be replaced or used in combination with a washing step (step S2A) to wash away and/or dissolve any matter that may be soluble in water or some other desired cleansing solution 112. If the washing step is employed, the washed composite blasting media is typically air dried or squeezed (step S2B) after the washing step to remove the residual liquid and/or moisture 114.

Next, the cleaned composite blasting media is mixed (step S3) with at least one of additional abrasive component and/or carrier component to replenish the consumed, fractured, abraded and/or spent abrasive component and/or carrier component. In Fig. 2, this mixture is typically heated (step S4) to a desired temperature, depending upon the composition of the carrier component, to melt the carrier component into liquid form and physically entrap, encapsulate and/or bond the added abrasive and/or carrier components with the recycled abrasive and carrier components.

The heated mixture of the composite blasting media is then thoroughly mixed to achieve a uniform mixture of the abrasive and the carrier components and allowed to

solidify (step S5). Thereafter, the solidified composite blasting media is extruded (step S6) through suitable extruding equipment, such as an extruder manufactured by American Mapla Corp., 283 South Bypass, Mcpherson, Kansas. The extruded composite blasting media is finally ground (step S7) by suitable grinding equipment, such as a grinder manufactured by Nelmor Plastic Machinery of Nuxbridge, Massachusetts (model #G1012M1), into a plurality of granules of a desired particle size, each granules comprising a plurality of abrasive components and carrier components physically interconnected with one another. The size of the granules is selected according to the blasting application for which the particles will be used.

Alternatively, depending upon the kind of material used as the carrier component, (Fig. 3) the recycled composite blasting media is collected (step S1), screened or sifted (step S2), and, if desired, washed (step S2A) and dried (step S2B), and then additional abrasive component and/or carrier component may be added to the cleaned composite blasting media (step S3), the same as with the previous embodiment. Thereafter, the mixture of the abrasive and carrier components is allowed to react and chemically bond with one another (step S4). The chemically bonded composite blasting media is then allowed to set or solidify (step S5), is extruded (step S6) by suitable extruding equipment, and finally ground (step S7) by suitable grinding equipment into granules of a desired particle size.

If a foam is used as a carrier component of the composite media, water or another liquid may be added to and absorbed by the foam carrier component (step 1A) which will cause the foam carrier component to swell to a larger particle size (Fig. 3). The swollen foam is much easier to separate in the screening or sifting step (step S2) as

the contaminates and debris, such as lead paint which are either not soluable or readily soluable in water, readily pass through the screen or other sifting member while the swollen foam carrier component, of a sufficiently larger size, containing the abrasive component is readily retained. The screened and swollen composite blasting media can then either be dried or squeezed, to remove the water or other cleaning fluid therefrom, before the composite blasting media is mixed with additional abrasive component and/or carrier component.

In an attempt to produce and recycle/recombine media on site, an experiment was performed by the inventors. Mixtures of hydrophilic polyol, gypsum and water were tried in various experiments. The gypsum proved to be very difficult to bond and dusted unacceptably when used in a blasting equipment. Accordingly, further tests with gypsum were abandon in favor of garnet and steel shot. A novel most useful two step portable mixture was developed by the inventors and they discovered that garnet, mixed with the hydrophilic polyol and water procedure, worked well.

If the composite blasting media comprises a slurry of water, or some other freezable liquid, and an abrasive component, the slurry is completely mixed and then frozen to solidify the mixture. Thereafter, the frozen liquid can then be ground into a plurality of discrete particles each containing the carrier component (e.g. water) and the abrasive component. In such grinding application, the grinder is typically located in a room which is maintained at a temperature below the freezing temperature of water or another liquid used as the carrier component, e.g. 0°C, to minimize any melting of the frozen slurry.

If a frozen liquid is used as the composite blasting media, preferably the blasting will occur in a temperature controlled or a chilled environment (e.g. below 0° C). Such an environment will minimize any melting of the

frozen liquid during use and to facilitate collection of the used blasting media, cleaning, and recycling of the blasting media.

Alternatively, it would be possible to impregnate or mechanically force the abrasive component into a pliable carrier component, such as a soft plastic (e.g. high density polyethylene; low density polyethylene; polypropylene; poly(vinyl chloride); polystyrene; ply(acrylonitrile-butadiene-styrene); and polyurethane), putty, etc. In order to recycle the plastic or putty containing an abrasive component, the fines, the contaminates and the other debris is first separated from the reusable media and then additional abrasive and/or carrier component, e.g. soft plastic and putty material, is added to the collected mixture. The abrasive is then impregnated or mechanically forced into the soft plastic or putty, thoroughly mixed, extruded, if necessary, and finally reground into particles of a desired particle size for further use.

It is possible to use an air washer to clean the collected blasting media (step S2). One such suitable air washer is manufacturer by Invincible Air Flow Systems of Dover, Ohio (model no. 700-10). It is also possible, depending on the type of debris or abrasive material used, to use a magnetic separator to separate the fines, the debris and the contaminates from the recyclable composite media material. A suitable magnetic separator is manufactured by Eriez Magnetics Inc. of Erie, Pennsylvania (model no. A magnetic rotor).

By recycling and regenerating most of the composite blasting media, a substantial cost savings in the amount of material which must be properly disposed of is achieved. Thus, the recyclable composite blasting media according to the present invention is beneficial to the environment in general.

Since certain changes may be made in the above described composite media without departing from the spirit and scope of the invention herein involved, it is intended that all subject matter contained in the above description and shown in the accompanying drawings shall not be construed as limiting the invention, but shall be interpreted merely as examples illustrating the inventive concept disclosed herein.

We claim:

1. A method of recycling a used composite blasting media after being propelled through desired blasting equipment, said composite blasting media comprising a plurality of granules which each contain a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component, which is a solid at the operating temperature,

said method comprising the steps of:

collecting the composite blasting media after at least one blasting cycle;

mixing at least one of additional abrasive component and additional carrier component with the collected composite blasting media; and

forming the mixture of composite blasting media into a plurality of granules each containing a plurality of discrete particles of the abrasive component physically interconnected with one another by the carrier component.

2. A method of recycling the composite blasting media of claim 1, further comprising the step of washing, in a washing device, the collected composite blasting media with a cleaning solution prior to the mixing step.

3. A method of recycling the composite blasting media of claim 2, further comprising the step of removing moisture from the washed composite blasting media, with a moisture removing mechanism, prior to the mixing step.

4. A method of recycling the composite blasting media of claim 1, further comprising the step of cleaning the collected composite blasting media, with a cleaning device, prior to the mixing step.

5. A method of recycling the composite blasting media of claim 1, further comprising the step of screening the collected composite blasting media prior to the mixing step.

6. A method of recycling the composite blasting media of claim 1, further comprising the step of using the composite blasting media a plurality of times prior to recycling the composite blasting media.

7. A method of recycling the composite blasting media of claim 1, wherein said mixing step comprises the step of mixing both additional abrasive component and additional carrier component with the collected composite blasting media.

8. A method of recycling the composite blasting media of claim 1, further comprising, after the collecting step but prior to the mixing step, the steps of:

causing the collected composite blasting media to swell by allowing the collected composite blasting media to absorb liquid; and

screening the swelled composite blasting media with a screening device so as to allow fines and other debris and contaminates to pass through the screening device while retaining the swollen composite blasting media.

9. A method of recycling the composite blasting media of claim 8, further comprising the step of removing the absorbed liquid from the composite blasting media with a liquid absorbing mechanism.

10. A method of recycling the composite blasting media of claim 1, wherein said forming step comprises the steps of:

heating the mixture of the composite blasting media to melt the carrier component, which is a solid at room temperature;

allowing the heated composite blasting media to cool to a solidifying temperature of the carrier component and thereby solidify the composite blasting media; and

grinding the composite blasting media into a plurality of granules each containing a plurality of

discrete particles of the abrasive component physically interconnected with one another by the carrier component.

11. A method of recycling the composite blasting media of claim 10, further comprising, prior to allowing the heated composite blasting media to solidify, the step of thoroughly mixing the heated composite blasting media to form a uniform mixture thereof.

12. A method of recycling the composite blasting media of claim 1, wherein said forming step comprises the steps of:

allowing the mixture of the composite blasting media with at least one of additional abrasive component and additional carrier component to chemically react with one another;

allowing the chemically reacted composite blasting media to solidify; and

grinding the composite blasting media into a plurality granules each containing a plurality of discrete particles of the abrasive component physically interconnected with one another by the carrier component.

13. A method of recycling the composite blasting media of claim 12, further comprising, prior to allowing the chemically reacted composite blasting media to solidify, the step of thoroughly mixing the mixture of the composite blasting media to form a uniform mixture thereof.

14. A method of recycling the composite blasting media of claim 1, wherein said forming step comprises the steps of:

impregnating additional abrasive component into the carrier component; and

grinding the composite blasting media into a plurality granules each containing a plurality of discrete particles of an abrasive component physically

interconnected with one another by the carrier component.

15. A method of forming a recyclable granulated composite blasting media for use in treating a surface to remove undesired contaminants therefrom, said composite blasting media being suitable for being propelled via a fluid stream through desired blasting equipment;

said method comprising the steps of:

forming granules of the composite blasting media, each said granule comprising a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component, which is solid at the operational temperature, the carrier component being selected to wear, during use of the composite blasting media, at a rate so as to continuously expose additional underlying abrasive particles on an exterior surface of that composite media particle, but not at a rate to allow the premature separation of the abrasive particles from an exterior surface of that composite media particle;

propelling the recyclable composite blasting media through desired blasting equipment to treated a desired surface;

collecting the composite blasting media with a collecting device and cleaning the collected composite blasting media, after at least one blasting cycle, with a cleaning device; and

reforming the composite blasting media into a plurality of granules each containing a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component.

16. A method of recycling the composite blasting media of claim 1, further comprising the steps of separating recyclable composite blasting media, with a separating device, from fines, debris and contaminates after the collecting step and prior to the mixing step.

17. A method of recycling a used composite blasting media after being propelled through desired blasting equipment, said composite blasting media comprising a plurality of

granules which each contain a plurality of discrete particles of an abrasive component physically interconnected with one another by a carrier component, which is solid at a temperature below room temperature,

said method comprising the following steps occurring at a temperature below room temperature:

collecting the composite blasting media after at least one blasting cycle;

mixing at least one of additional abrasive component and additional carrier component with the collected composite blasting media; and

forming the mixture of composite blasting media into a plurality of granules each containing a plurality of discrete particles of the abrasive component physically interconnected with one another by the carrier component.

18. A method as claimed in any one of claims 1 to 16 and wherein the operational temperature is an ordinary room temperature.

19. A method of providing reformed composite blasting media substantially as herein described with reference to Fig. 2 or Fig. 3 of the accompanying drawings.

20. Reformed composite blasting media produced by the method of any one of the preceding claims.

Dated this 7th day of September 1998

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By their Patent Attorneys
GRIFFITH HACK
Fellows Institute of Patent
Attorneys of Australia

76348/94

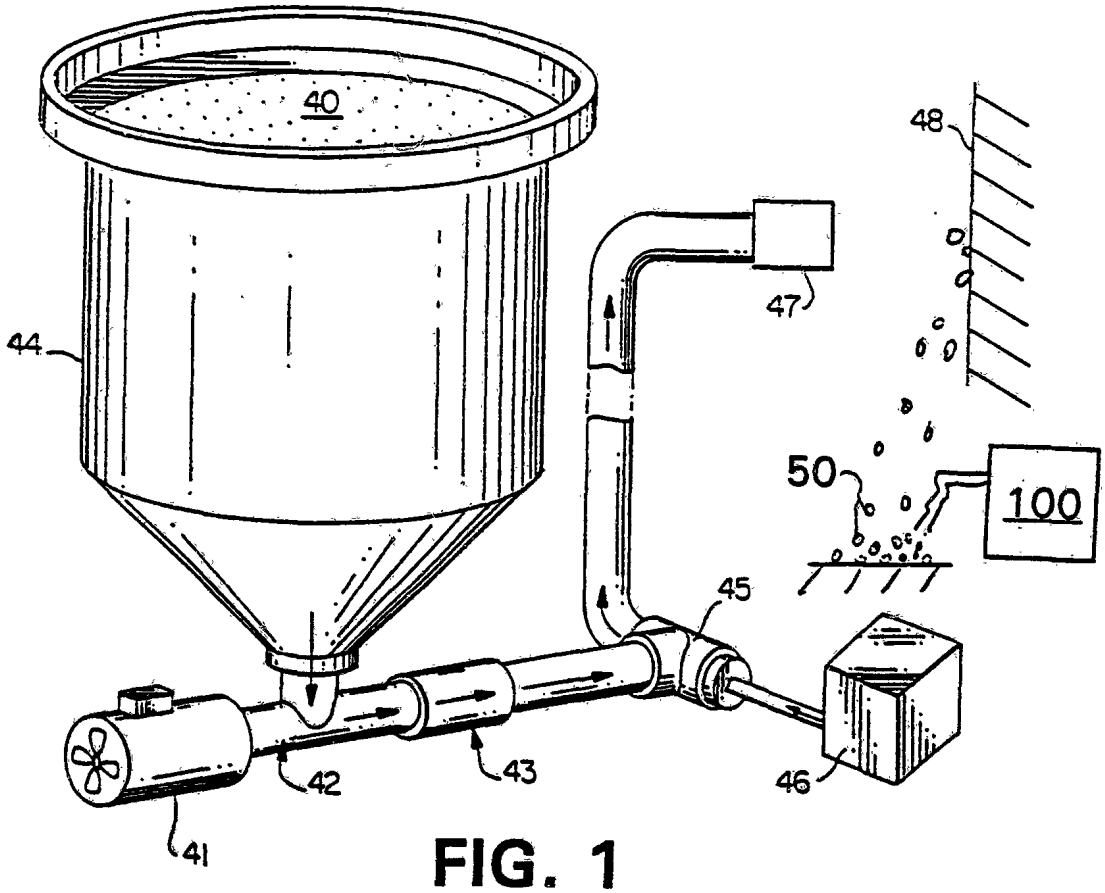

FIG. 1

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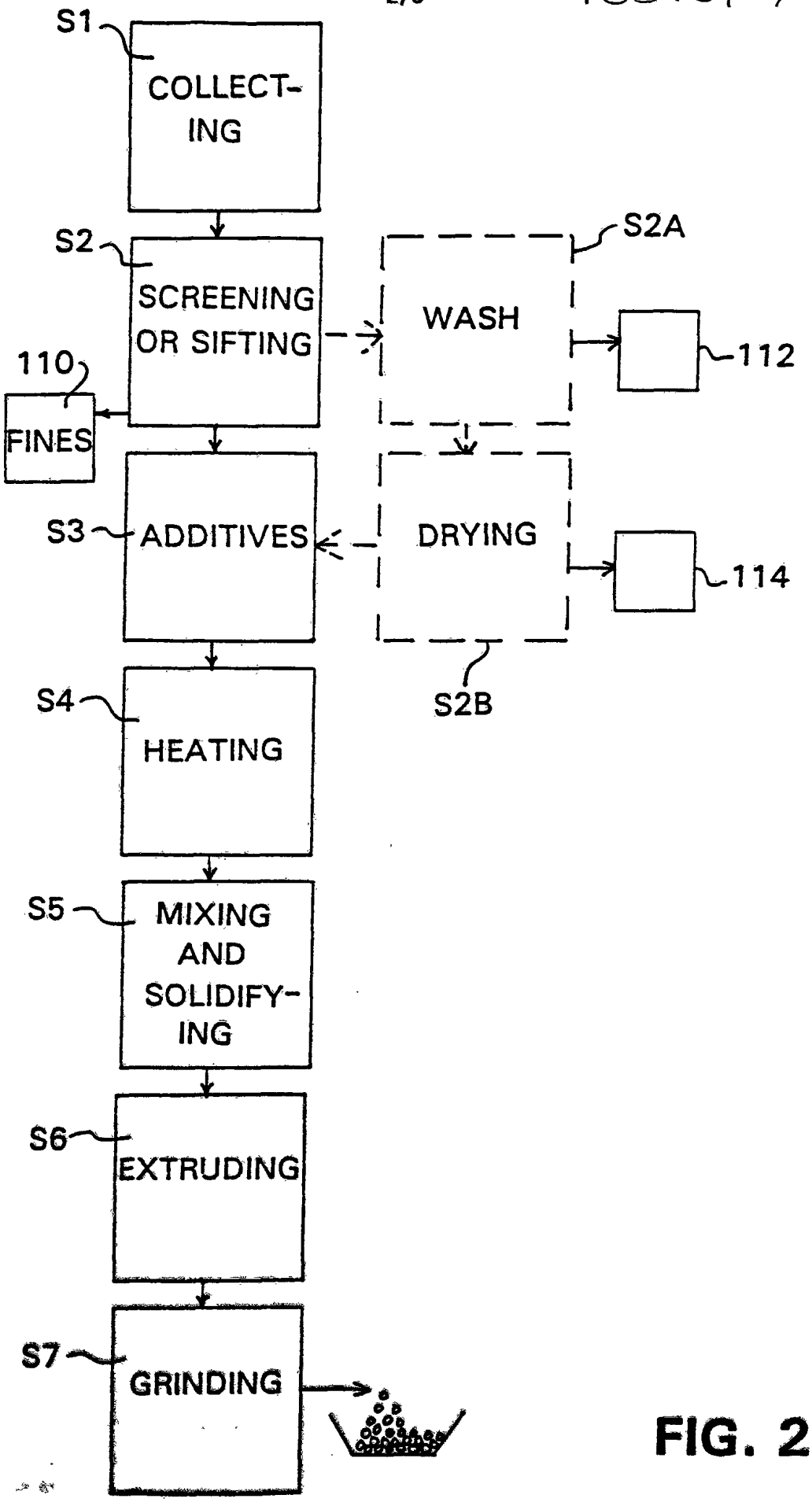

FIG. 2

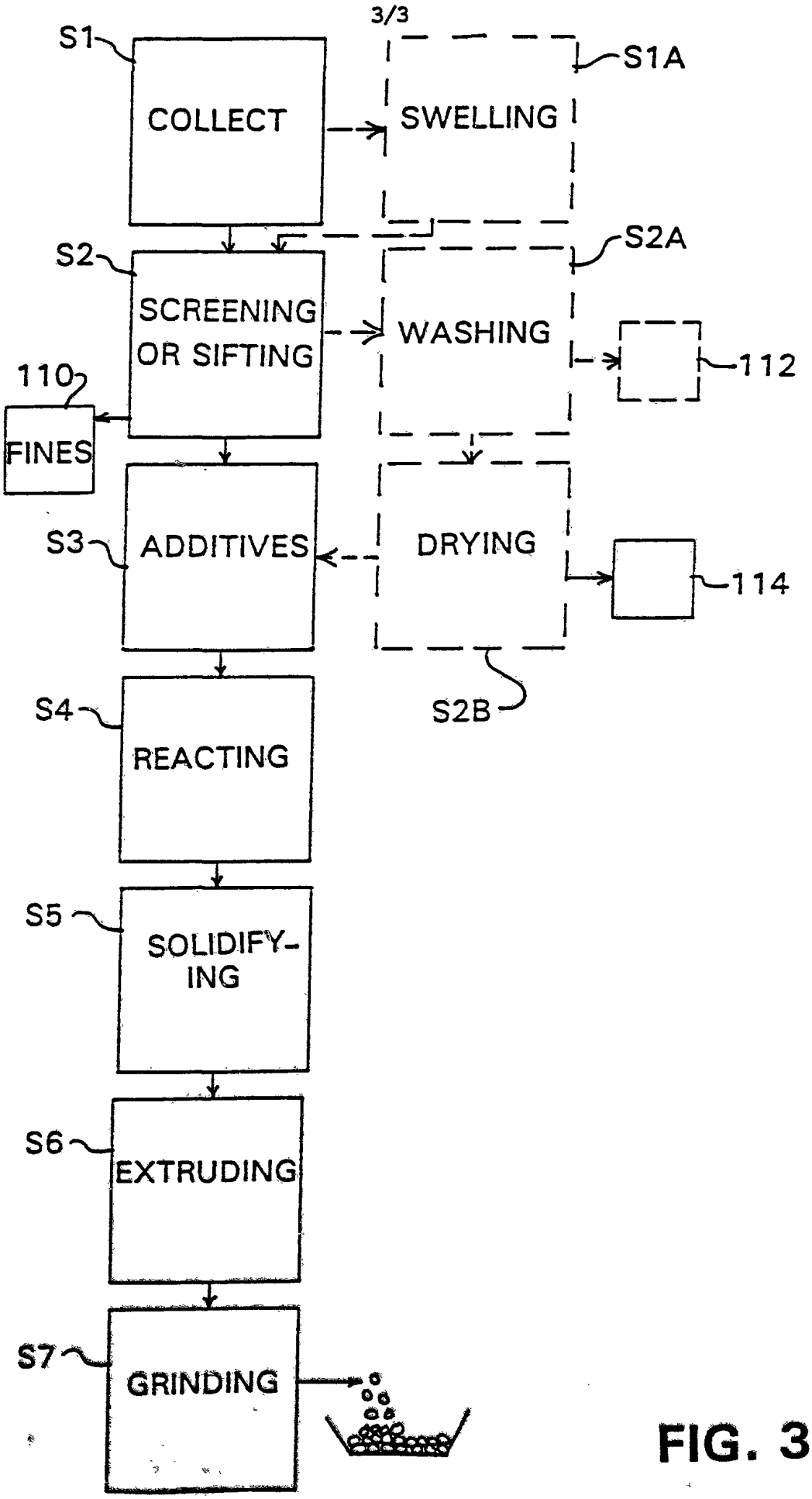
S1
COLLECT
S1A
SWELLING
S2
SCREENING OR SIFTING
S2A
WASHING
112
110
FINES
S3
ADDITIVES
DRYING
114
S2B
S4
REACTING
S5
SOLIDIFY-ING
S6
EXTRUDING
S7
GRINDING

FIG. 3

INTERNATIONAL SEARCH REPORT

Ii. ational application No.
PCT/US94/09411

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B24D 3/00
US CL : 51/293; 451/38, 75
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 51/293; 451/38, 75

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A, 2,426,072 (Wallet et al) 19 August 1947, see entire document.	1-17
A	US,A, 4,827,678 (MacMillan et al) 09 May 1989, see entire document.	1-17
A	US,A, 5,146,716 (Lynn) 15 September 1992, see entire document.	1-17
&	US,A, 5,234,470 (Lynn et al) 10 August 1993, see entire document.	1-17

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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

Date of the actual completion of the international search	Date of mailing of the international search report
08 DECEMBER 1994	06 JAN 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DEBORAH JONES Telephone No. (703) 308-3822

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

In..ational application No.
PCT/US94/09411

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
&	US,A, 5,256,703 (Hermann et al) 26 October 1993, see entire document.	1-17
&	US,A, 5,344,472 (Lynn et al) 06 September 1994, see entire document.	1-17