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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: METHOD FOR FORMING A FIRE RESISTANT CELLULOSE PRODUCT, AND ASSOCIATED APPARATUS

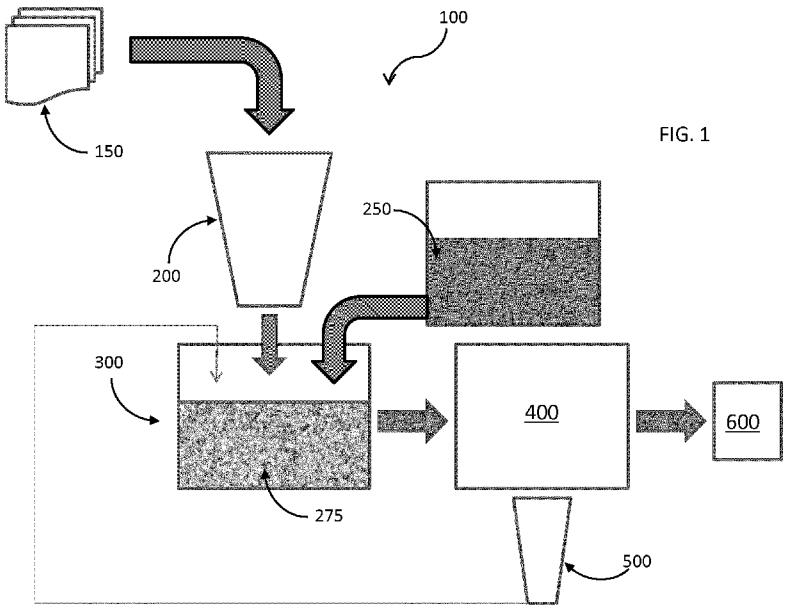

FIG. 1

(57) Abstract: A method is provided for forming a fire resistant cellulose product. Such a method comprises processing cellulose fibers into a fiber mixture, and forming a slurry from the fiber mixture and a fire-retarding solution, wherein the slurry has the fire-retarding solution substantially uniformly distributed therethrough. The slurry is then formed into a cellulose product. An associated apparatus is also provided.

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METHOD FOR FORMING A FIRE RESISTANT CELLULOSE PRODUCT, AND ASSOCIATED APPARATUS

BACKGROUND OF THE DISCLOSURE

Field of the Disclosure

Aspects of the present disclosure relate to methods for forming fire resistant products, and, more particularly, to a method for forming a fire resistant cellulose product, and associated apparatuses.

Description of Related Art

It may sometimes be desirable for particular products to exhibit resistance to fire. For example, it may be desirable for paperboard products used in building construction to exhibit a certain degree of fire resistance. In the case of drywall, which generally comprises a gypsum core with paperboard facing sheets, it is the gypsum core, and not the paperboard facing sheets, which is relied upon to provide some fire resistance capabilities. However, since drywall is comprised of two different materials, it may be difficult and/or relatively expensive to produce. Further, the fire resistance capabilities of drywall may not necessarily be enough to make a significant difference in the overall construction of the building.

In some instances, a paperboard product may have a fire-retardant product applied thereto, post-formation, to provide some fire resistance capabilities for the paperboard product. That is, an exemplary as-formed paperboard product may have a surface treatment, for example, a liquid fire retardant, applied thereto in order for the treated product to exhibit at least some fire resistance. In such instances, however, one possible limitation in the treatment of the as-formed paperboard product for fire resistance, particularly with a liquid fire retardant, is achieving an even and consistent treatment of that product. More particularly, the result of some fire resistance treatment processes involving application of a liquid fire-retardant to an as-formed paperboard product may be an uneven or otherwise inconsistent coverage of the fire retardant with respect to the product. In those cases, the uneven treatment may result in varying levels of fire resistance of the treated paperboard product which may, in turn, become a hazard in the event of a fire which the product is intended to retard or otherwise provide some resistance. Further, such treatment processes may not necessarily be efficient in terms of applying the fire

retardant to the paperboard product, may not include provisions for capturing or recycling excess portions of the fire retardant product, and may not have the capability for preventing or restricting losses of the fire retardant due, for instance, to evaporative processes.

Thus, there exists a need for a process and associated apparatus for evenly and consistently applying a fire retardant, particularly a liquid fire retardant, to a cellulose product such as, for example, a paperboard product. In some instances, it may be desirable to form an integral cellulose product having the characteristics of an existing product having two or more discrete components (i.e., drywall), while also providing an enhanced level of fire resistance. It may also be desirable, in some instances, to have a paperboard formation process with the capability of capturing excess fire retardant and recycling the captured excess in subsequent cellulose product manufacturing cycles, whether the excess is captured in a liquid form or in other forms, such as vapors.

BRIEF SUMMARY OF THE DISCLOSURE

The above and other needs are met by aspects of the present disclosure, wherein one such aspect relates to a method of forming a fire resistant cellulose product. Such a method comprises processing cellulose fibers into a fiber mixture, and forming a slurry from the fiber mixture and a fire-retarding solution, wherein the slurry has the fire-retarding solution substantially uniformly distributed therethrough. The slurry is then formed into a cellulose product.

Another aspect of the present disclosure relates to an apparatus for forming a fire resistant cellulose product. Such an apparatus comprises a processing device configured process cellulose fibers into a fiber mixture, and a mixing device configured to form a slurry from the fiber mixture and a fire-retarding solution, such that the fire-retarding solution is substantially uniformly distributed therethrough. A forming device is configured to then form the slurry into a cellulose product.

In particular aspects, the fire-retarding solution may be an aqueous fire-retarding solution. It may be preferred that the fire-retarding solution be nontoxic and/or have a neutral pH and/or be hypoallergenic and/or have any number of otherwise desirable properties. In some aspects, the fire-retarding solution may comprise any one of a boron compound, a borate, an inorganic hydrate, a bromine compound, aluminum hydroxide, magnesium hydroxide,

hydromagnesite, antimony trioxide, a phosphonium salt, ammonium phosphate, and diammonium phosphate, or various combinations thereof.

In still further aspects, the processing device may be configured to process waste paper and/or waste board, each comprising cellulose fibers, into the fiber mixture. Further, the mixing device may be configured, for example, to add water to the cellulose fibers to form the slurry, and/or to agitate the slurry so as to substantially uniformly distribute the fire-retarding solution therethrough.

In further aspects, the forming device may be configured to dewater the slurry and to dry the dewatered slurry to form the cellulose product. In doing so, the slurry may be compressed to form a densified cellulose product and/or heated to form a dried cellulose product. The forming device may also be configured to dry the slurry to form a substantially planar cellulose product having one of a thickness of between about 0.125 inches and about 2 feet, and a width of between about 1 inch and about 8 feet.

In some instances, the forming device may be configured to engage the slurry with one of a negative die and a positive die, so as to form a cellulose product having a surface defining a negative impression of the one of the negative die and the positive die.

In yet other aspects, the apparatus may also comprise a recovery device configured to recover excess fire-retarding solution, in one of a liquid and a vapor form, upon the forming device forming the slurry into the cellulose product. Further, the recovery device may be configured to direct the recovered excess fire-retarding solution to the mixing device, for example, in a closed-loop, fire-retarding solution recycling process.

Aspects of the present disclosure thus address the identified needs and provide other advantages as otherwise detailed herein.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described the disclosure in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 schematically illustrates an apparatus for forming a fire resistant cellulose product, according to one aspect of the disclosure; and

FIG. 2 schematically illustrates a method of forming a fire resistant cellulose product, according to one aspect of the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

The present disclosure now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all aspects of the disclosure are shown. Indeed, the disclosure may be embodied in many different forms and should not be construed as limited to the aspects set forth herein; rather, these aspects are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

Aspects of the present disclosure are generally directed to apparatuses and methods for forming a fire resistant cellulose product. As previously discussed, one possible limitation in the treatment of as-formed cellulose products, such as a paperboard product, for fire resistance, particularly with a liquid fire retardant, is achieving an even and consistent treatment of that cellulose product. That is, the result of some fire resistance surface-treatment processes may be an uneven or otherwise inconsistent application of the fire retardant to the cellulose product. In those cases, such uneven surface treatment may result in varying levels of fire resistance of the treated cellulose product which may, in turn, become a hazard in the event of a fire which the product is intended to retard or otherwise provide some resistance.

As such, one aspect of the present disclosure involves an apparatus for forming a fire-resistant cellulose product, such an apparatus being indicated as element 100 in FIG. 1. Such an apparatus 100 may comprise, for example, a processing device 200 configured to process cellulose fibers into a fiber mixture, a mixing device 300 configured to form a slurry from the fiber mixture and a fire-retarding solution, such that the fire-retarding solution is substantially uniformly distributed therethrough, and a forming device 400 configured to form the slurry into a cellulose product.

The processing device 200 may be configured to process cellulose fibers from one or more sources 150 into a fiber mixture. That is, though aspects of the present disclosure contemplate that the cellulose products may be comprised of recycled cellulose fibers (i.e., from waste paper, waste board, waste paperboard, or any other suitable waste source of cellulose fibers), one skilled in the art will appreciate that raw, original, or otherwise virgin cellulose fibers may also be used in addition to, in combination with, or instead of the recycled/waste cellulose fibers. Further, in some aspects, the cellulose fibers may not necessarily be required to be free of contaminants, as long as those contaminants can be processed along with the cellulose fibers to

form the fiber mixture. For example, where the source of cellulose fibers includes waste pizza boxes, those waste pizza boxes do not necessarily need to be free of pizza components, such as cheese, in order for those pizza boxes to be processed by the processing device 200. As such, a decontamination process may not necessarily be contemplated, but could be included, should there be a need or desire for a contaminant-free cellulose product. In addition, the cellulose fibers do not necessarily need to be dry prior to being processed by the processing device 200. That is, waste sources of cellulose fibers may be, in some instances, in the form of bales, wherein the bales may often be exposed to the elements (i.e., rain or condensation) prior to being introduced to the processing device 200. In those instances, aspects of the present disclosure are also configured to process the "wet" source of cellulose fibers into the fiber mixture. In this regard, the cellulose fibers may be processed by the processing device 200, regardless of the moisture level present therein, into the fiber mixture. The extent of the processing of the cellulose fibers may vary considerably depending, for example, on the level of refinement (i.e., coarse / fine) desired of the final cellulose product. The processing device 200 may be any machine suitable for deconstructing the waste cellulose fibers in the manner discussed, wherein one such exemplary machine may be manufactured by Metso Paper, Inc. of Helsinki, Finland.

Once the fiber mixture is produced in the desired state by the processing device 200, the fiber mixture may be directed to the mixing device 300, where the fiber mixture is mixed with a fire-retarding solution 250 to form a slurry 275, and the slurry 275 is mixed such that the fire-retarding solution is substantially uniformly distributed therethrough. In some instances, the mixing device 300 may be configured to add water and/or other appropriate liquid or chemical to the fiber mixture in forming the slurry.

In particular aspects, the fire-retarding solution 250 may be an aqueous fire-retarding solution. It may be preferred that the fire-retarding solution be nontoxic and/or have a neutral pH and/or be hypoallergenic and/or have any number of otherwise desirable properties affecting human / animal and/or environmental safety, while maintaining the necessary efficacy, as implemented and upon exposure to heat and/or flame. In some aspects, the fire-retarding solution 250 may comprise any one of a boron compound, a borate, an inorganic hydrate, a bromine compound, aluminum hydroxide, magnesium hydroxide, hydromagnesite, antimony trioxide, a phosphonium salt, ammonium phosphate, and diammonium phosphate, or various combinations thereof. In this regard, one skilled in the art will appreciate that various fire-

retarding or fire resistant substances, either currently known or later developed or discovered, may be applicable to the disclosed processes and apparatuses herein within the scope of the present disclosure.

One skilled in the art will further appreciate that the fire-retarding solution may be formed by adding a solid fire-retardant product to a liquid (i.e., water) or other chemical mixed with the fiber mixture such that the solid fire-retardant product forms a solution with the liquid or other chemical comprising the slurry with the fiber mixture. In some instances, the mixing device 300 may be configured to agitate the slurry or pulp mixture, so as to substantially uniformly distribute the fire-retarding solution therethrough. The mixing device 300 may be any machine suitable for forming the slurry 275 from the fiber mixture and the fire-retarding solution, in the manner discussed, wherein one such exemplary machine may be manufactured by Metso Paper, Inc. of Helsinki, Finland.

The forming device 400 is configured to receive the slurry 275 from the mixing device 300 and to form the slurry into a cellulose product 600. In some instances, the forming device 400 may be configured to dewater the slurry, before drying the dewatered slurry to form the cellulose product. Such a dewatering process may be accomplished, for example, by a suitably modified Fourdrinier-type machine, or other appropriate process, as will be appreciated by one skilled in the art. The slurry may also be dewatered, for instance, using a twin wire forming section and/or appropriate screening devices. In other instances, whether dewatered or not, the slurry may be compressed by the forming device 400 to form a densified cellulose product and/or heated by the forming device 400 to form a dried cellulose product. Compression of the slurry may be accomplished, for instance, using a screw press or other suitable press device. Heat may be applied to the slurry, for example, via heated air (i.e., heated with combusted natural gas or other suitable fuel source), or through any of a variety of heating/drying methods, such as, for example, microwave or infrared drying techniques, as will be appreciated by one skilled in the art.

One skilled in the art will also appreciate that the forming device 400 may be configured in many different manners. For example, a suitably-configured screen device may be configured to receive the slurry, wherein the screen device may include a number of perforations. Once deposited in the screen device, the slurry may be engaged by an opposing platen, which may also be perforated. The perforations may serve to dewater the slurry, while the platen and/or the

screen device may be heated to provide for drying of the dewatered slurry. Further, pressure may be applied to the screen device and/or the platen, for example, using a hydraulic or screw-type pressure device, so as to compress the slurry while the slurry is dewatered and heated. In some desirable aspects, the forming device 400 may also be configured to form the slurry into a substantially planar cellulose product 600 having a thickness of between about 0.125 inches and about 2 feet, and/or a width of between about 1 inch and about 8 feet. One skilled in the art will appreciate, however, that the dimensions of the planar cellulose product may vary considerably. In still other aspects, the cellulose product 600 may be formed as a sheet having a desired length, or as a continuous sheet that is later subdivided into segments of a desired length. In some instances, the forming device 400 may be configured to engage the slurry with one of a negative die and a positive die, so as to form a cellulose product having a surface defining a negative impression of the one of the negative die and the positive die. That is, for example, the screen device and/or the platen may be appropriately patterned with a raised and/or depressed pattern such that the formed cellulose product will have a corresponding surface defining a negative impression of the pattern. One skilled in the art will also appreciate that the capability of manipulating the slurry in this manner indicates that the final form of the cellulose product need not necessarily be in planar form, but may take many different shapes, contours, and sizes in addition to that disclosed herein.

In other aspects, the apparatus 100 may also comprise a recovery device 500 configured to recover excess fire-retarding solution, in one of a liquid and a vapor form, upon the forming device 400 forming the slurry into the cellulose product. In some instances, the recovery device 500 may also be configured to engage the mixing device 300 for accomplishing the recovery of the excess fire-retarding solution. Further, the recovery device 500 may be configured to direct the recovered excess fire-retarding solution to the mixing device 300, for example, in a closed-loop, fire-retarding solution recycling process. Upon recovery of the excess portions, including liquids and vapors, by the recovery device 500, the recovered excess fire-retarding solution may be strained, filtered, or otherwise purified, and then reintroduced to the mixing device 300 to form subsequent cellulose products, such that the fire-retarding solution is substantially or entirely prevented from leaving the apparatus 100 as a waste product.

In addition, in some instances, the as-formed cellulose product may be further processed, for example, to planarize certain surfaces thereof, or to remove "broke" or otherwise planarize

the edges of the cellulose product. In such instances, the apparatus 100 may also include a collection device (not shown), wherein the collection device may be configured to capture waste solids from the post-formation processing of the cellulose product. In those instances, the captured waste solids may be incorporated into other products (i.e., blown-in insulation) while providing fire-resistance properties therefor.

Many modifications and other aspects of the disclosures set forth herein will come to mind to one skilled in the art to which these disclosures pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. For example, one skilled in the art that the apparatuses disclosed herein readily lead to associated processes and methods for forming a fire resistant cellulose product, as shown, for example, in FIG. 2. More particularly, such methods may comprise processing cellulose fibers into a fiber mixture (block 700), and forming a slurry from the fiber mixture and a fire-retarding solution, wherein the slurry has the fire-retarding solution substantially uniformly distributed therethrough (block 800), and then forming the slurry into a cellulose product (block 900).

Further, one skilled in the art will appreciate that, in some aspects, the slurry, dewatered slurry, and/or cellulose product may be formed as a general cellulose element that can then be formed, molded, or otherwise manipulated into various end products such as, for example, boards, compounded roofing shingles, compounded roofing shakes, compounded sidewall shingles, compounded Spanish style "red clay" type roof tiles, electrical outlet encasements, doors, interior wall planking, exterior sheathing, cabinetry cores, cupboards, compounded cabinet door faces, flooring, laminated flooring, veneered compounded flooring, or the like. However, the exemplary end products presented herein are not intended to be limiting in any manner with respect to the wide variety of contemplated end products. Thus, the general cellulose element concept may be extend to instances where the end product may be produced in many different manners such as, for example, by molding, extrusion, pressing, stamping, or by any other suitable production method.

Moreover, the general cellulose element concept may be applicable where the general cellulose element is provided as a component or other portion of a further end assembly. Particularly, as shown in such previous examples as laminated flooring and cored cabinetry, the general cellulose element incorporating the fire-retarding solution forms a component of the end assembly. One skilled in the art will thus appreciate that cellulose products in accordance with

aspects of the present disclosure may be produced such that the fire-retarding solution is dispersed at least partially, if not consistently and uniformly, throughout. As such, the components of the end assembly comprising the fire-retarded cellulose product may likely be wholly resistant to fire and/or unable to ignite on a more permanent basis (i.e., since the fire-retarding solution is effectively integrated into the cellulose product), as compared to simple surface treatments that may be easily removed, washed away, or subject to degradation over time.

Therefore, it is to be understood that the disclosures are not to be limited to the specific aspects disclosed and that modifications and other aspects are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

THAT WHICH IS CLAIMED:

1. A method of forming a fire resistant cellulose product, said method comprising:
processing cellulose fibers into a fiber mixture;
forming a slurry from the fiber mixture and a fire-retarding solution, the slurry having the fire-retarding solution substantially uniformly distributed therethrough; and
forming the slurry into a cellulose product.

2. A method according to Claim 1, wherein processing cellulose fibers into a fiber mixture further comprises processing one of waste paper and waste board, each comprising cellulose fibers, into the fiber mixture.

3. A method according to Claim 1, wherein forming a slurry further comprises adding water to the fiber mixture.

4. A method according to Claim 1, wherein forming a slurry further comprises forming a slurry from the fiber mixture and a fire-retarding solution comprising one of a boron compound, a borate, an inorganic hydrate, a bromine compound, aluminum hydroxide, magnesium hydroxide, hydromagnesite, antimony trioxide, a phosphonium salt, ammonium phosphate, diammonium phosphate, and combinations thereof.

5. A method according to Claim 1, further comprising agitating the slurry so as to substantially uniformly distribute the fire-retarding solution therethrough.

6. A method according to Claim 1, wherein forming the slurry into a cellulose product further comprises:
dewatering the slurry; and
drying the dewatered slurry to form the cellulose product.

7. A method according to Claim 1, wherein forming the slurry into a cellulose product further comprises compressing the slurry to form a densified cellulose product.

8. A method according to Claim 1, wherein forming the slurry into a cellulose product further comprises heating the slurry to form a dried cellulose product.

9. A method according to Claim 1, wherein forming the slurry into a cellulose product further comprises drying the slurry to form a substantially planar cellulose product having one of a thickness of between about 0.125 inches and about 2 feet, and a width of between about 1 inch and about 8 feet.

10. A method according to Claim 1, wherein forming the slurry into a cellulose product further comprises engaging the slurry with one of a negative die and a positive die, so as to form a cellulose product having a surface defining a negative impression of the one of the negative die and the positive die.

11. A method according to Claim 1, further comprising recovering excess fire-retarding solution, in one of a liquid and a vapor form, upon forming the slurry into the cellulose product.

12. A method according to Claim 11, wherein forming a slurry further comprises adding the recovered excess fire-retarding solution to the slurry, prior to forming the slurry into the cellulose product.

13. A method according to Claim 1, forming a slurry further comprises forming a slurry from the fiber mixture and one of an aqueous fire-retarding solution, a nontoxic liquid fire-retarding solution, and a neutral pH liquid fire-retarding solution.

14. An apparatus for forming a fire resistant cellulose product, said apparatus comprising:

a processing device configured process cellulose fibers into a fiber mixture;

a mixing device configured to form a slurry from the fiber mixture and a fire-retarding solution, such that the fire-retarding solution is substantially uniformly distributed therethrough; and

a forming device configured to form the slurry into a cellulose product.

15. An apparatus according to Claim 14, wherein the processing device is configured to process one of waste paper and waste board, each comprising cellulose fibers, into the fiber mixture.

16. An apparatus according to Claim 14, wherein the mixing device is configured to add water to the fiber mixture.

17. An apparatus according to Claim 14, wherein the mixing device is configured to forming a slurry from the fiber mixture and a fire-retarding solution comprising one of a boron compound, a borate, an inorganic hydrate, a bromine compound, aluminum hydroxide, magnesium hydroxide, hydromagnesite, antimony trioxide, a phosphonium salt, ammonium phosphate, diammonium phosphate, and combinations thereof.

18. An apparatus according to Claim 14, wherein the mixing device is configured to agitate the slurry so as to substantially uniformly distribute the fire-retarding solution therethrough.

19. An apparatus according to Claim 14, wherein the forming device is configured to dewater the slurry, and to dry the slurry to form the cellulose product.

20. An apparatus according to Claim 14, wherein the forming device is configured to compress the slurry to form a densified cellulose product.

21. An apparatus according to Claim 14, wherein the forming device is configured to heat the slurry to form a dried cellulose product.

22. An apparatus according to Claim 14, wherein the forming device is configured to dry the slurry to form a substantially planar cellulose product having one of a thickness of between about 0.125 inches and about 2 feet, and a width of between about 1 inch and about 8 feet.

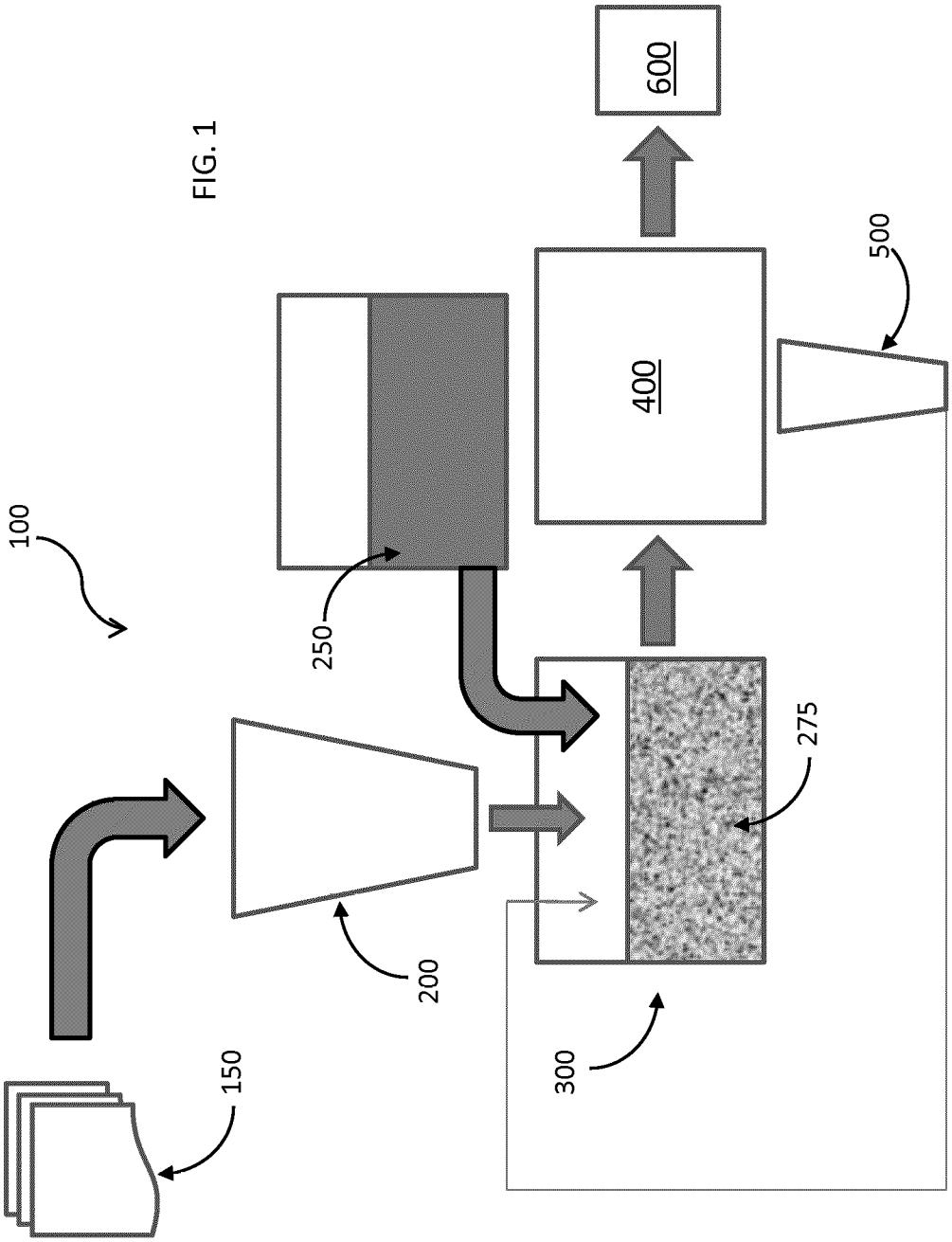
23. An apparatus according to Claim 14, wherein the forming device is configured to engage the slurry with one of a negative die and a positive die, so as to form a cellulose product having a surface defining a negative impression of the one of the negative die and the positive die.

24. An apparatus according to Claim 14, further comprising a recovery device configured to recover excess fire-retarding solution, in one of a liquid and a vapor form, upon the forming device forming the slurry into the cellulose product.

25. An apparatus according to Claim 24, wherein the recovery device is configured to direct the recovered excess fire-retarding solution to the mixing device.

26. An apparatus according to Claim 14, wherein the mixing device is configured to forming a slurry from the fiber mixture and one of an aqueous fire-retarding solution, a nontoxic liquid fire-retarding solution, and a neutral pH liquid fire-retarding solution.

FIG. 1



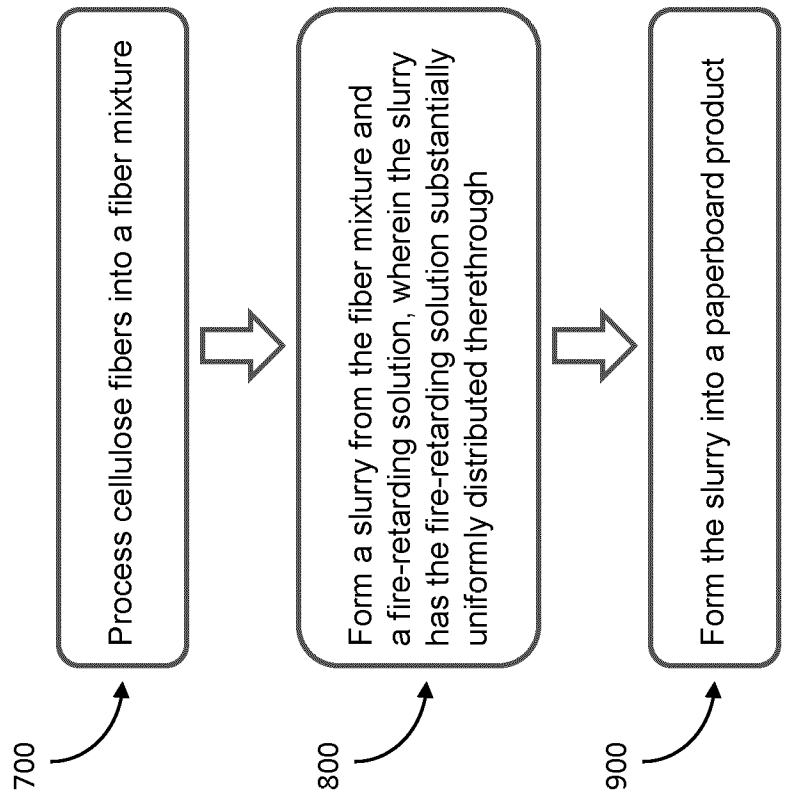

Process cellulose fibers into a fiber mixture
Form a slurry from the fiber mixture and a fire-retarding solution, wherein the slurry has the fire-retarding solution substantially uniformly distributed therethrough
Form the slurry into a paperboard product
700
800
900

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2010/000419

A. CLASSIFICATION OF SUBJECT MATTER

IPC: ***D21H 21/14*** (2006.01) , ***D21H 17/63*** (2006.01) , ***D21J 1/00*** (2006.01) , ***D21J 3/00*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: ***D21H 21/14*** (2006.01) , ***D21H 17/63*** (2006.01) , ***D21J 1/00*** (2006.01) , ***D21J 3/00*** (2006.01)

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

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

Canadian Patent Database, EPOQUENET + keywords: fire, retardent, cellulose

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	**CA 1,147,911** (Herr) 14 June 1983 (14-06-1983)	1-6, 8-19 and 21-26
Y	[whole document]	7 and 20
X	**US 4,032,393** (Alfeis et al.) 28 June 1977 (28-06-1977)	1-6, 8-19 and 21-26
Y	[whole document]	7 and 20
X	**US 3,245,870** (Orth et al.) 12 April 1966 (12-04-1966)	1-6, 8-19 and 21-26
Y	[whole document]	7 and 20
Y	**US 1,754,843** (Vivas) 15 April 1930 (15-04-1930) [whole document]	7 and 20

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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

"E" earlier application or patent but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 November 2010 (17-11-2010)	24 November 2010 (24-11-2010)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Malcolm Downey (819) 934-2329

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	**GB 370,391** (Clark) 30 March 1932 (30-03-1932) [whole document]	7 and 20

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2010/000419

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