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(54) Title: AEROSPACE WARNING TAGS

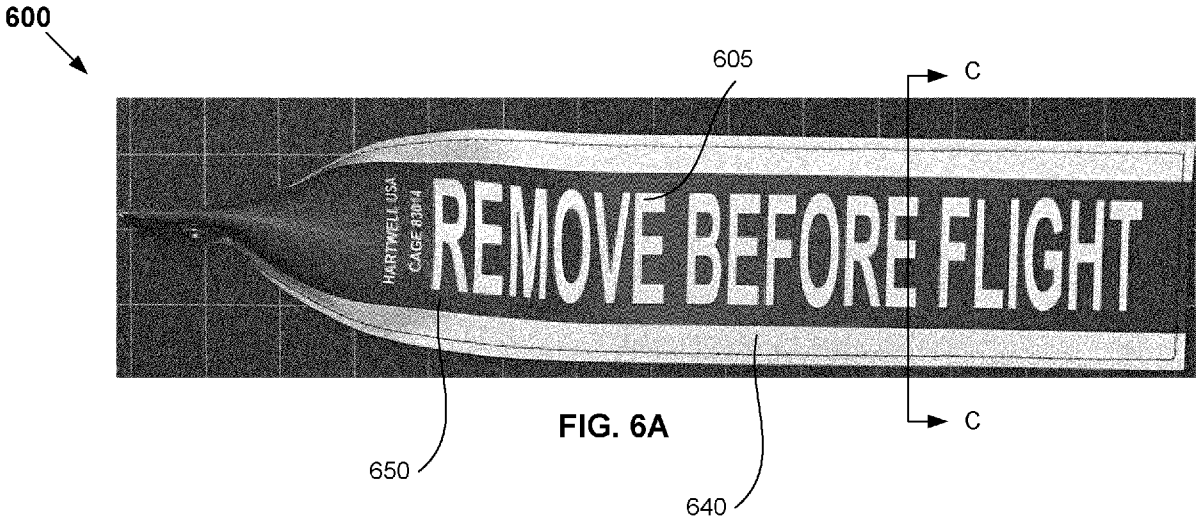

FIG. 6A

(57) Abstract: A warning tag and process of making the warning tag are provided. The warning tag has a substrate layer, a reflective layer laid on top of the substrate layer, and a negatively printed message on the reflective layer. In some embodiments, the reflective layer is covered with non-reflective ink to form the non-reflective ink coating such that a warning indicia message is left exposed while the surrounding area thereto is covered. A process of making such warning tags is also provided.

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AEROSPACE WARNING TAGS

[0001] This application claims the benefit of U.S. provisional patent application No. 62/963,318 filed on January 20, 2020.

Field of the Invention

[0002] The invention relates generally to the field of warning devices and procedures, and more particularly to an aerospace warning tag.

Background of the Invention

[0003] Several countries have lockout/tagout and warning standards for the purposes of preventing injuries and deaths caused by the accidental or untimely start-up of equipment during maintenance or servicing. Portions of these standards deal with proper shutdown or other steps taken to render the machinery inoperative prior to maintenance, energy source management, and user training. In addition, the marking or tagging of machine while it is lined up for servicing or maintenance, or while it is in the midst of such servicing or maintenance forms a part of some of these standards. In any event, even where standards do not exist there are benefits to providing lockout tags or indicia for the tagging or marking of machinery undergoing servicing or maintenance.

[0004] One industry in which lockout, warning, and 'remove before flight' tags are used is in the servicing of aircraft, and aircraft ground support equipment. Lockout and tagout tags are intended to be readily and suitably attached to the aircraft, be highly visible, and provide the appropriate indicia to alert a pilot or service technician that an aircraft or service equipment is not fit for flight or service. The level of caution may be presented by the color of the tag. U.S. Patent 9,799,236, the contents of which are herein incorporated by reference in their entirety, discloses a lockout tag.

[0005] Warning tags, which comply with the National Aerospace Standard NAS-1756, and NAS-1091 offer a way to improve aerospace safety by standardizing the material and construction of aerospace flags. These flags remind pilots and aircraft maintenance technicians to remove these items before flight. The warning tags must be physically removed prior to flight ensuring that they were

seen and accounted for. These flags contain various messages, such as "Remove Before Flight" and can be used as physical reminders of pre-flight checks that must be completed before takeoff.

[0006] One challenge in the warning tags is that when the ambient light is dim the text of the warning indicia of the warning tag cannot be viewed clearly. Accordingly, there is a need in the art for an improved warning tag that is easily viewable in the dark and/or in low-light conditions.

SUMMARY

[0007] In accordance with one aspect of the present invention there is provided a warning tag having: a substrate layer; a reflective layer laid on top of the substrate layer; and a negatively printed message on the reflective layer.

[0008] In some embodiments, the reflective layer is covered with non-reflective ink to form the non-reflective coating such that a warning indicia message is left exposed while the surrounding area thereto is covered.

[0009] In accordance with another aspect of the present invention there is provided a process of making a warning tag, the process including: affixing a reflective layer on top of a substrate layer; and negatively printing a warning message on the reflective layer.

[0010] In some embodiments, the negative printing of the warning message involves, covering the reflective layer with non-reflective ink to form the non-reflective ink coating such that a warning indicia message is left exposed while the surrounding area thereto is covered.

Brief Description of the Drawings

[0011] Embodiments are now be described, by way of example only, with reference to the attached Figures, wherein:

[0012] **FIG. 1** is a perspective view of a prior art lockout tag in the form of a "CAUTION" flag;

[0013] **FIG. 2** is a top plan view of a prior art warning tag in the form of a flag having a microprismatic reflective layer and non-reflective lettering;

[0014] **FIG. 3** is a sectional view taken at line **A-A** of **FIG. 2**;

[0015] **FIG. 4A** is a top plan view of a prior art warning tag in the form of a flag having reflective edge strips and non-reflective lettering;

[0016] **FIG. 4B** is a sectional view taken at line **B-B** of **FIG. 4A**;

[0017] **FIG. 5** is a black-and-white top plan view of a prior art warning tag similar to that of **FIG. 4A** under low-light and a camera flash condition;

[0018] **FIG. 6A** is a top plan view of a warning tag in the form of a flag having a layer of negative printing of letters on a reflective sheet, in accordance with an embodiment of the present disclosure;

[0019] **FIG. 6B** is a cross-sectional view of the warning tag taken at line **C-C** of **FIG. 6A**;

[0020] **FIG.7** shows another embodiment of the warning tag of **FIG. 6A**, showing the reflective negative printed warning tag properties;

[0021] **FIG. 8** shows the layer of negative lettering used in the lockout tag of **FIGS. 6A** and **6B**; and

[0022] **FIG. 9** shows a process diagram for the steps of making the warning tag of **FIG. 6A**.

Description of the Embodiments

[0023] In this disclosure, the terms “comprising”, “having”, “including”, and “containing”, and grammatical variations thereof, are inclusive or open-ended and do not exclude additional, un-recited elements and/or method steps. The term “consisting essentially of” when used herein in connection with a composition, use or method, denotes that additional elements, method steps or both additional

elements and method steps may be present, but that these additions do not materially affect the manner in which the recited composition, method, or use functions. The term "consisting of" when used herein in connection with a composition, use, or method, excludes the presence of additional elements and/or method steps.

[0024] In this disclosure, the term "ink" may include one or more of: solvent, UV-curable, aqueous and latex inks, dye, paint, stain, pigment, tint, varnish or other colorant that is color-fast and appropriately weather resistant.

[0025] In this disclosure, "negative printing" could be achieved with any number of inks, paints and processes for applying them. In particular a wide format inkjet technology may be used.

[0026] **FIG. 1** shows a prior art lockout tag in the form of a flag **100** as disclosed in US Patent 9,799,236. The flag **100** is generally elongate in shape and is approximately 45 cm long and 8 cm wide. The flag **100** comprises a main body **104**, a centrally-located warning indicia **108**, and a circular eye (or orifice) **102**. The warning indicia **108** may state such messages as "Caution – Out of Service", "Danger – Do not Operate", "Remove Before Flight", or any other suitable safety message. The circular eye **102** or oval eye-type connector is for affixing the flag **100** to an aircraft or machinery being subject to lockout/tagout procedures.

[0027] The lockout tags, such as the flag **100**, may be reflective (retroreflective or otherwise) and fluorescent, such as Reflexite® (Oralite® GP 340 Highlight) produced by Orafol Europe GmbH, and preferably by virtue of a reflective square-shaped pattern, heat sealed or high frequency welded directly into the material in order to improve viewing angle of the tags. The flag may comprise a reflective and fluorescent material on one side or both sides. The reflective durable nature of the tag provides increased visibility during various lighting conditions, from varying viewing angles and in out-door rainy/foggy conditions. Reflective tags are also useful in many areas where machinery are generally stored or maintained, for example in warehouses or manufacturing facilities with low lighting conditions. Reflective tags may also be useful in out-of-the-way, hard to see locations or for elevated energy source lockout locations.

[0028] Optionally, a portion or the entirety thereof may be provided in the form of a photo-luminescent surface for particular benefit in low-light, or no-light, environments.

[0029] Each of the tags may also be made to conform to lockout/tagout standards, such as the ANSI Z535.2-2011 standard from OSHA standard 1910.147, Control of Hazardous Energy or Lock out/Tag out, which states that "safety signs shall be displayed with illumination or retro-reflectorization as needed for adequate legibility under normal operating conditions. Where illumination is inadequate or colors are not recognizable the use supplemental illumination may be applied.

[0030] **FIG. 2** and **FIG. 3** depict a prior art warning tag in the form of a flag **300**. The flag **300** is comprised of a substrate layer **310** on which a such as a warning indicia **305** is printed. A microprismatic diffuser layer **330** is superimposed on top of the substrate layer **310** and the warning indicia **305.** The microprismatic diffuser layer **330** glows in low-light conditions. However, if exposed to sunlight for a long period of time, the microprismatic diffuser layer **330** deteriorates and loses its properties. Accordingly, the warning indicia becomes less visible under low light conditions which is undesirable.

[0031] **FIGS. 4A** and **4B** depict a prior art warning tag in the form of a flag **400**. This design overcomes the problem with the microprismatic diffusion layers deteriorating under sunlight by utilizing reflective strips as described herein. The flag **400** is comprised of a substrate layer **410**. In one embodiment, the substrate layer is coated with a background paint **420** of a darker color and warning indicia **405** covered in a lighter colour, as shown. A pair of reflective edge strips **440** are affixed to the substrate layer **410** on the edges thereof to surround the warning indicia **405**, as shown. The reflective edge strips may be stitched or glued to the substrate layer, or affixed thereto by other suitable means.

[0032] **FIG. 5** shows a black and white image of the flag **400** under low light conditions and including the use of a camera flash. As shown in **FIG. 5**, the reflective edge strips **440** are showing indicating that the flag **400** is a warning tag. However, the warning indicia is not showing since it is not made of reflective material like edge strips **440**. Accordingly, a user is unable to read the text of the warning indicia which is undesirable.

[0033] In order to overcome the shortcoming of the flag **400** of **FIGS. 4A-4B** and **FIG. 5**, the warning indicia message may be made from the same reflective material as the reflective edge strips.

In one embodiment, the individual letters forming the warning indicia text would be cut from the reflective material, and individually affixed to a substrate layer. This process is labour intensive and costly.

[0034] **FIGS. 6A-6B**, depict a warning tag in the form of a flag **600**, in accordance with an embodiment of the present disclosure. The warning tag **600** has an elongated substrate layer **610** having a predetermined length and a predetermined width. The substrate layer has a top-side reflective coating **640**. The top-side reflective coating **640** is covered with non-reflective ink **630** such that the warning indicia message **605** is left exposed while the surrounding area thereto is covered or coated. This is best shown in **FIG. 8**, which shows a non-reflective ink coating **650** leaving the warning indicia text **605** exposed.

[0035] In one embodiment, the non-reflective ink coating **650** has a length similar to that of the substrate layer **610** and the reflective top-side coating **630**, but has a width smaller than the reflective top-side reflective coating **640** which leaves two edge strips of the reflective layer exposed. The warning indicia **605**, formed on the top-side coating layer **640**, is negatively-formed thus constituting a negative lettering of the warning indicia **605**.

[0036] Light shining on the flag **600** will reflect on the edge strips and on the warning indicia **605**. Accordingly, an observer will both determine the presence of a lockout tag or 'remove before flight' flag and read the text of the warning indicia **605**.

[0037] In exemplary embodiments, a number of ink formulations may be utilized in wide format inkjet printers, including solvent, UV-curable, aqueous (water-based) and latex inks. Such printers are commercially available from manufacturers such as EFI and AGFA.

[0038] **FIG. 7** shows a black-and-white image of another embodiment of a flag **700**, exemplary of another embodiment of the present invention, under good lighting conditions. The text of the warning indicia **705** can be read by a user in addition to the edge strips **740**.

[0039] **FIG. 8** shows the layer of negative lettering used in the lockout tag of **FIG. 6A** and **FIG. 6B.**

[0040] **FIG. 9** shows a flowchart of an exemplary process **900** for printing the warning message on the warning tag, summarizing the major steps involved. At step **910** a reflective strip is affixed on a substrate layer. At **920**, a warning message is negatively printed on the reflective layer.

[0041] During negative printing, the reflective strip is covered with non-reflective ink such that the warning indicia message is left exposed or uncovered while the surrounding area thereto is coated or covered. Further, in this embodiment, the negative printing leaves edges of reflective materials uncovered for added reflectivity as specified in step **930**.

[0042] In alternate embodiments, this process may be used on a glass bead reflective layer or a microprismatic layer.

[0043] In at least some embodiments of the present invention, a digital printing process is used with ink that is meant for outdoor use, such as on road signs for the negative printing step.

[0044] Some prior art methods simply screen print reflective lettering from inks that are made with a slurry of glass beads and cured in an oven. Examples of screen printing reflective lettering can be seen in the apparel industry. However, these inks used in the prior art are not meant for outdoor use and deteriorate rapidly due to exposure to ultraviolet rays. Glass bead inks are also not abrasion resistant, so they tent to wear off, crack or flake over time.

[0045] Advantageous, the ink used in embodiments of the present invention, is meant for outdoor use and thus mitigates the problems wearing off, cracking or flaking.

[0046] Other disadvantages with screen printing glass bead inks include the fact that, small part numbers cannot be reliably printed as the screen tends to smear fine details of lettering. In particular, it is difficult to achieve legible printing with a screen printing process for lettering or text that is 1/4" or less in height whereas embodiments of the present invention are able to print legible letters that are ¼ inch in height or less. Further, it is also not feasible to digitally print glass bead ink due to the size of the glass beads not being able to go through the print bead.

[0047] Other prior art methods involve die cut reflective lettering that is applied to a backing and heat transferred to a fabric sub straight. The drawback of this process is that it is often difficult to achieve a good adhesion that lasts in outdoor conditions.

[0048] At least some of the aforementioned shortcomings can be overcome with embodiments of the present invention as described above.

[0049] The above-described embodiments are presented by way of example only. Various modifications and alternatives are also contemplated to fit within the scope of the invention as defined by the claims.

CLAIMS:

1. A warning tag, comprising:

   a substrate layer;

   a reflective layer laid on top of the substrate layer; and

   a negatively printed message on the reflective layer.

2. The warning tag of claim 1, wherein the negatively printed message is printed using a digital printing process utilizing ink that is suitable for outdoor use.

3. The warning tag of claim 2, wherein the said digital printing process comprises wide format inkjet technology.

4. The warning tag of claim 1, wherein the reflective layer comprises a glass bead reflective layer.

5. The warning tag of claim 1, wherein the reflective layer comprises a microprismatic layer.

6. The warning tag of claim 1, further comprising edge strips on the reflective layer.

7. The warning tag of claim 1, wherein the reflective layer is covered with non-reflective ink to form the non-reflective ink coating such that a warning indicia message is left exposed while the surrounding area thereto is covered.

8. The warning tag of claim 7, wherein the non-reflective ink coating has a length similar to that of the substrate layer and the reflective layer, but has a width smaller than the reflective layer.

9. The warning tag of claim 8, further comprising edge strips on the reflective layer, wherein the edge strips are left exposed.

10. A process of making a warning tag, the process comprising:

affixing a reflective layer on top of a substrate layer; and

negatively printing a message on the reflective layer.

11. The process of claim 10, wherein said negatively printing the message comprises leaving two edge strips of the reflective layer exposed.

12. The process of claim 10, wherein the reflective layer comprises a glass bead reflective layer.

13. The process of claim 10, wherein the reflective layer comprises a microprismatic layer.

14. The process of claim 10, wherein said negatively printing said message comprises, covering the reflective layer with non-reflective ink to form the non-reflective ink coating such that a warning indicia message is left exposed while the surrounding area thereto is covered.

15. The process of claim 14, wherein said negatively printing said message further comprises, leaving two edge strips of the reflective layer exposed.

16. The process of claim 15, wherein the non-reflective ink coating has a length similar to that of the substrate layer and the reflective layer, but has a width smaller than the reflective layer.

17. The process of claim 10, further comprising providing the substrate layer.

18. The process of claim 10, wherein said negatively printing comprises using a digital printing process utilizing ink that is suitable for outdoor use.

19. The process of claim 10, wherein said message comprises text that is ¼ inch or less in height.

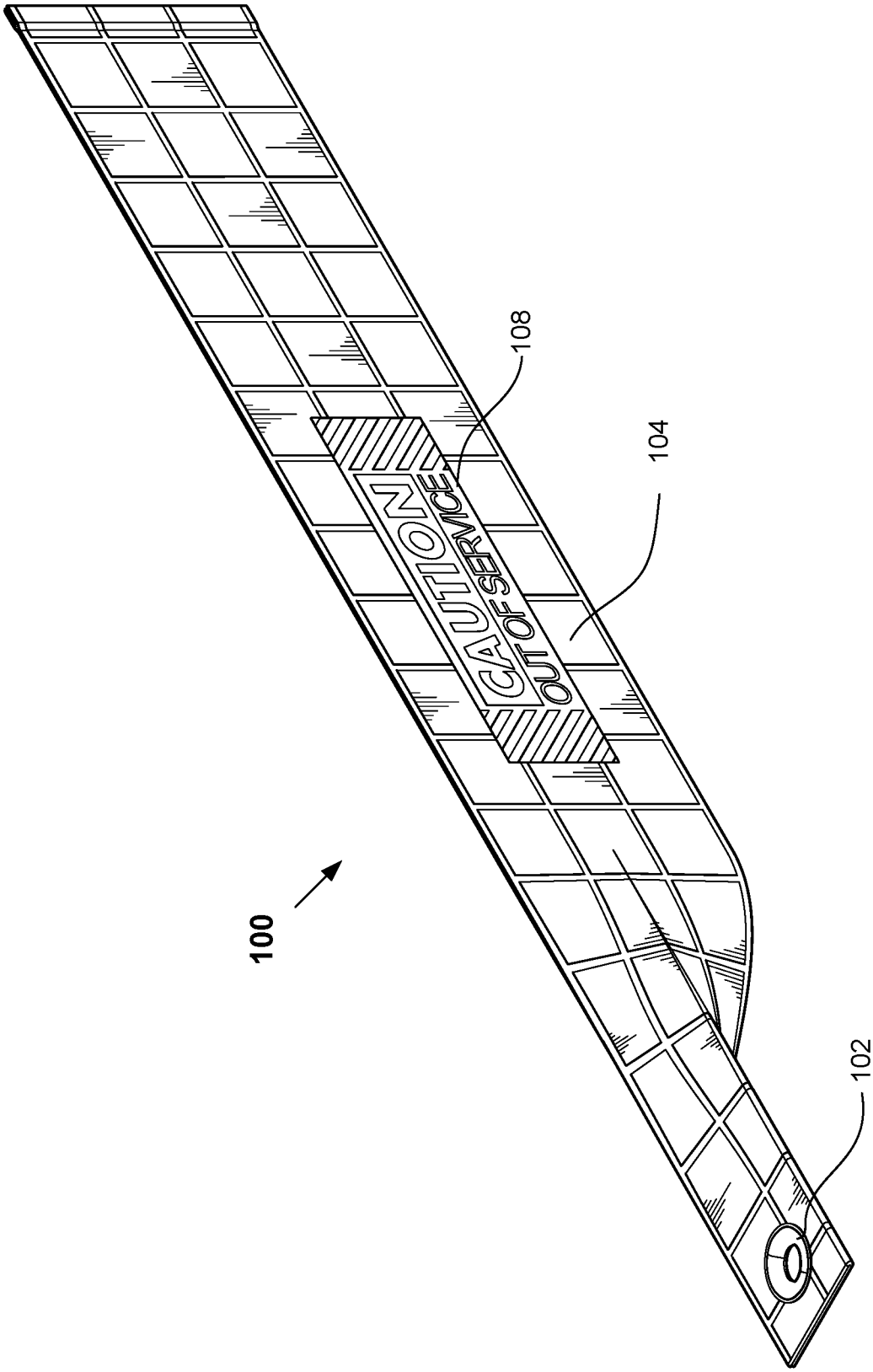

FIG. 1 (Prior Art)

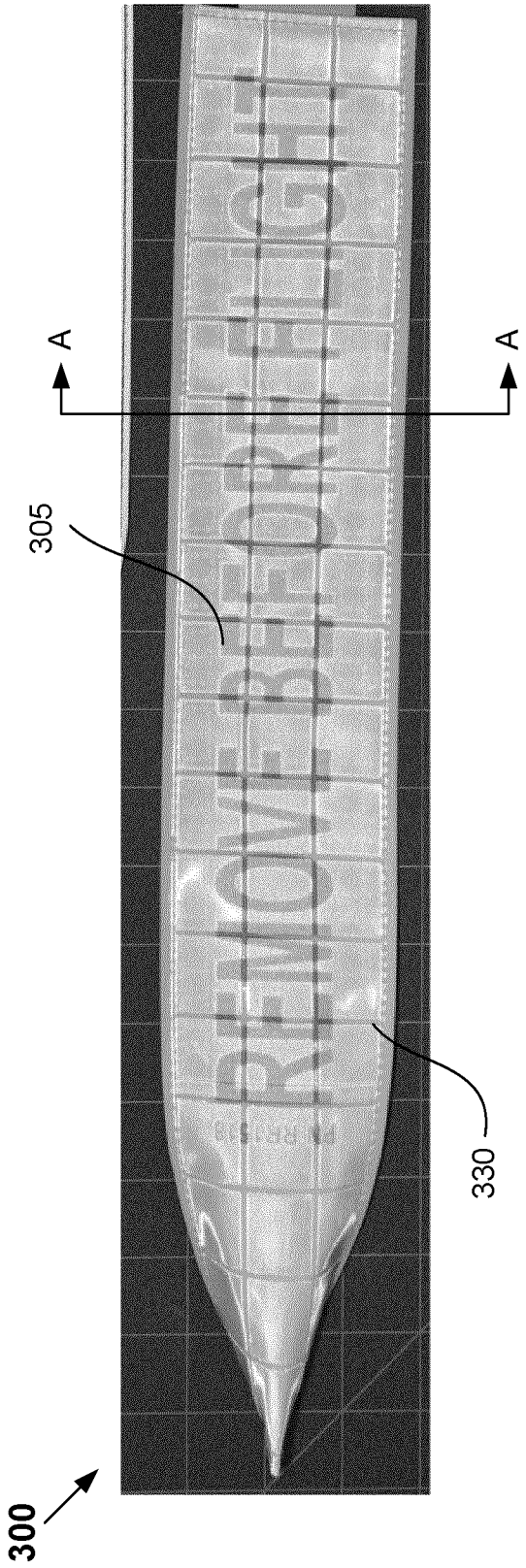

FIG. 2 (Prior Art)

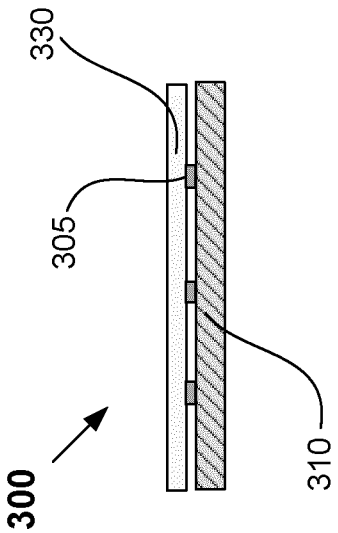

FIG. 3 (Prior Art)

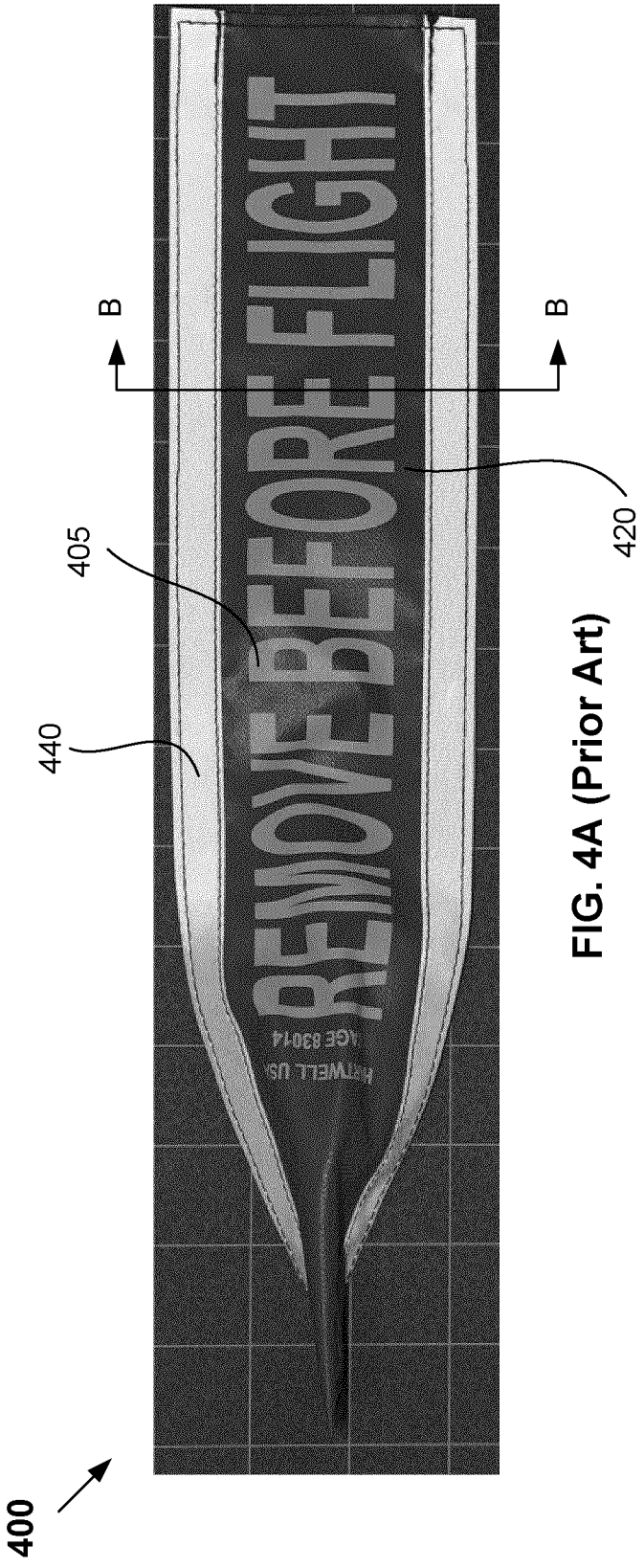

FIG. 4A (Prior Art)

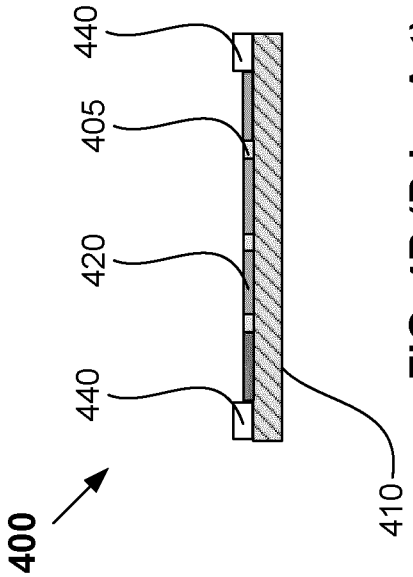

FIG. 4B (Prior Art)

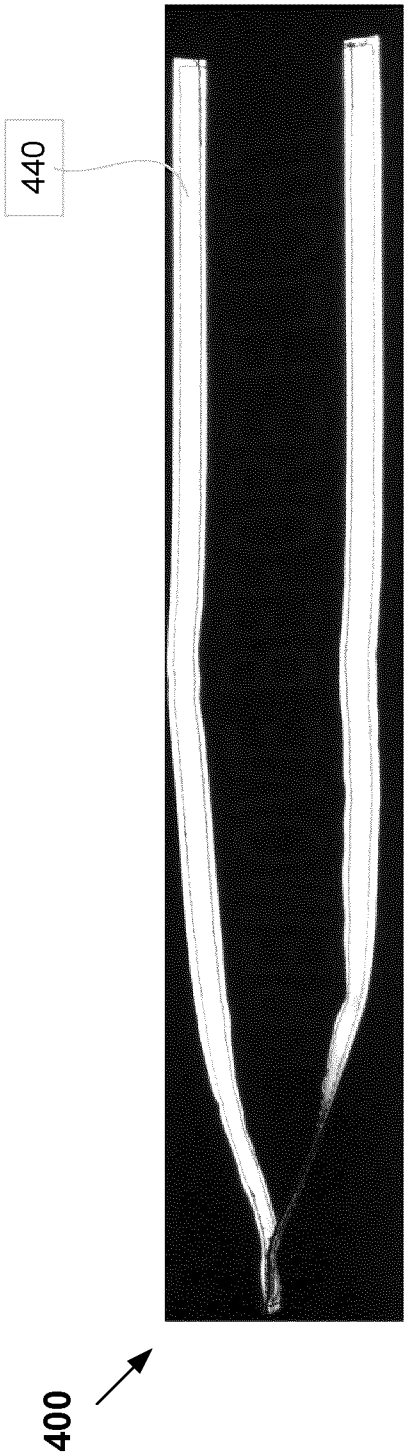

FIG. 5 (Prior Art)

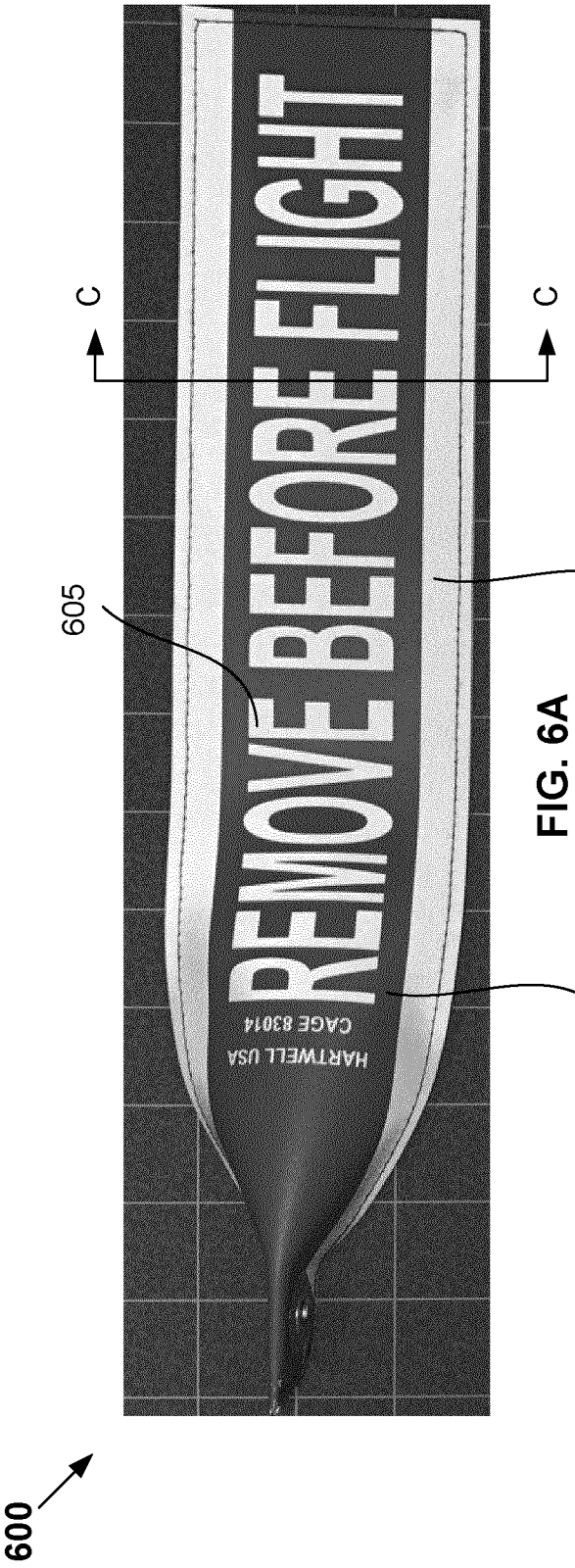
REMOVE BEFORE FLIGHT
HARTWELL USA
CAGE 83014
C
C
605
640
650
600

FIG. 6A

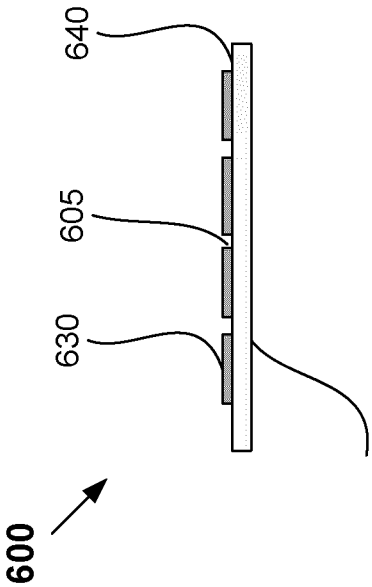
640
605
630
610
600

FIG. 6B

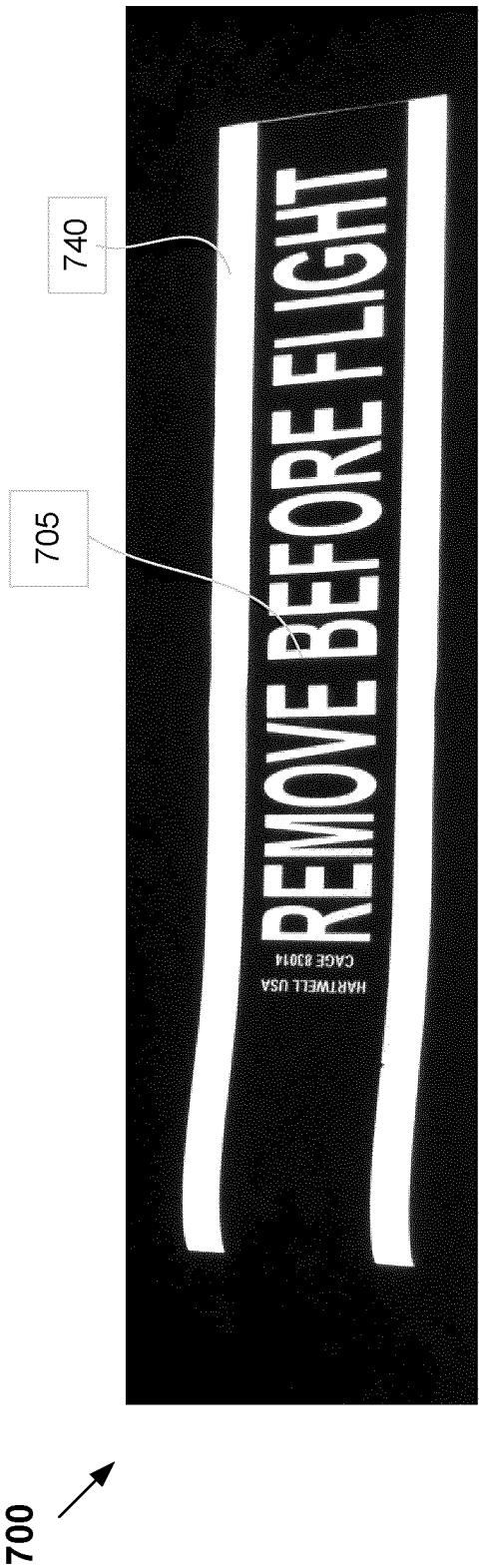

FIG. 7

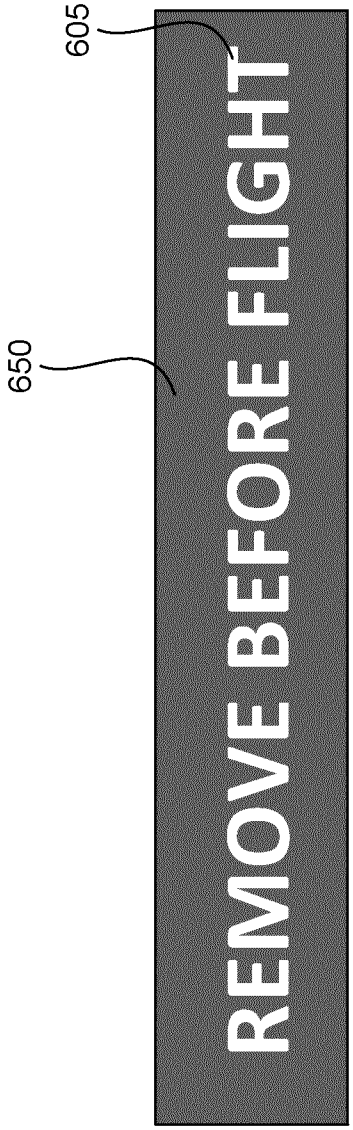

FIG. 8

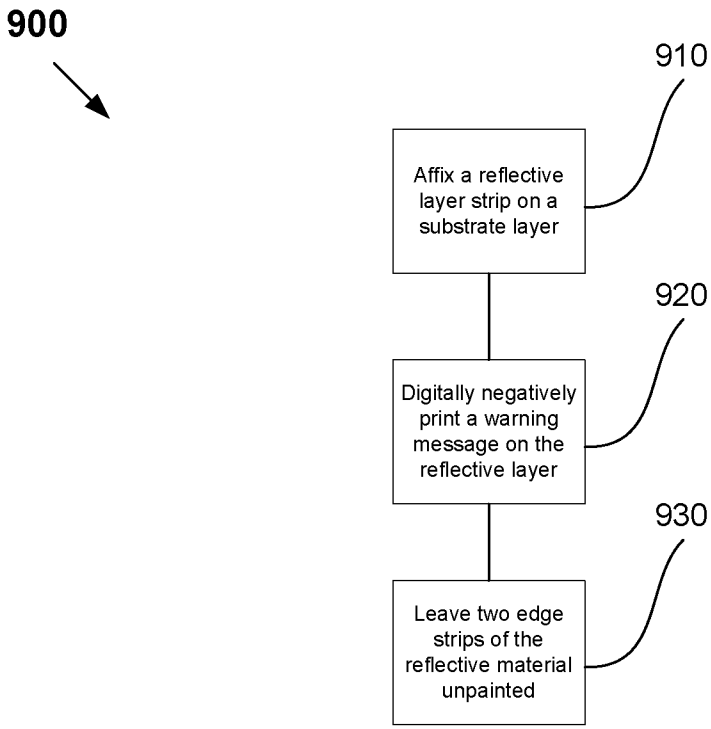
900
910
Affix a reflective layer strip on a substrate layer
920
Digitally negatively print a warning message on the reflective layer
930
Leave two edge strips of the reflective material unpainted

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2021/050053

A. CLASSIFICATION OF SUBJECT MATTER
IPC: **G09F 3/02** (2006.01) , ***B41J 2/01*** (2006.01) , ***B41J 3/00*** (2006.01) , ***G02B 1/11*** (2015.01) , ***G02B 5/128*** (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)
G09F (2006.1), B41J (2006.1), G02B (2006.1).

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
none

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Intellect (Canadian Patent Database), Questel-Orbit (FamPat Database).
Keywords : tag, warning, layer, reflective, print and negative.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US3936567 A (Vesely) 3 February 1976 (03-02-1976); *whole document*	1-19
Y	WO2014/161667 A1 (Hoffmuller et al.) 9 October 2014 (09-10-2014). *whole document*	1-19

☐ 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
"D"	document cited by the applicant in the international application	"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
"E"	earlier application or patent but published on or after the international filing date	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 17 March 2021 (17-03-2021)	Date of mailing of the international search report 16 April 2021 (16-04-2021)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476	Authorized officer Sorin Muntean (819) 639-7875

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2021/050053

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US3936567A	03 February 1976 (03-02-1976)	CA1029006A	04 April 1978 (04-04-1978)
WO2014161667A1	09 October 2014 (09-10-2014)	CN105263719A	20 January 2016 (20-01-2016)
		CN105263719B	24 October 2017 (24-10-2017)
		DE102013005937A1	09 October 2014 (09-10-2014)
		EP2981419A1	10 February 2016 (10-02-2016)
		EP2981419B1	14 June 2017 (14-06-2017)