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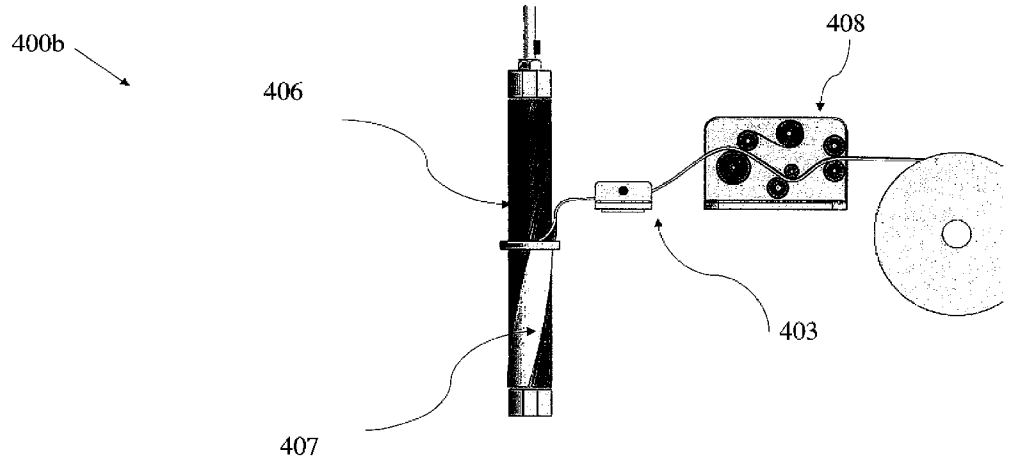

FIG. 4B

(57) Abstract: A manufacturing method and a machine for manufacturing to enable pasting of felt strips onto an article used in a surface treatment appliance, including a base frame (101, 401), an article feed-in system having a mandrel guide (102, 404) attached at a vertically top portion of the base frame (101, 401), a felt feed-in system (300) having a felt roller guide (103) connected to one or more comers of the base frame (101, 401), an assembly system (400) having a felt insert station (104) for pasting a felt strip to the article (406) and an article main guide attached vertically below the mandrel guide (102, 404) at the center of the base frame (101, 401) wherein the felt strip is guided by the linear downward force of the mandrel guide and a rotational force from a main guide of the article generates a momentum which causes the felt strip to adhere to the article in a spiral orientation, a detachment system (500a) having a cylinder housing, a cutter (502) to detach the felt strip from its roll and a network of sensors (503, 503a, 503b) having a first sensor activated

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SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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when pasting process is completing causing the cutter to be extended, a second sensor that causes the cutter (502) to be retracted once the felt is cut, and a third sensor configured to detect completion of cutting and release of the article from the gripper (504).

METHOD AND MACHINE FOR MANUFACTURING OF AN ARTICLE USED IN A SURFACE TREATMENT APPLIANCE

FIELD OF INVENTION

The present invention relates to a method and apparatus for the pasting of a fabric along the length of exterior of an article used in a surface treatment appliance. More particularly, the invention relates to a method of manufacturing a machine to paste felt strips onto the brush bar of a vacuum cleaner.

BACKGROUND OF THE INVENTION

Surface treatment appliances such as vacuum cleaners have a motor driven agitator in the form of a roller/cylindrical brush bar. One type of brush bar has a cylindrical core wrapped with soft padding material (nylon felt) having rows of bristles.

The rotation of the brush bar causes the bristles to sweep along the floor surface, loosening dirt and dust and picking up debris. The soft padding in turn, seals the floor surface directly to the cleaner head, improving the pick-up of solid debris and fine particles.

Over the years, the manufacture of the roller brush bar has raised various challenges. Wrapping the soft padding around the brush bar requires precision because four separate felt strips have to be pasted to the brush bar in the specified area without covering the bristle strips slots. The slots have to be left open to place the bristle strips in a later process. Furthermore, for the manufacturing process either a customized machine is to be produced or the manufacturing is to be done with manpower. Utilizing manual labour results in a slower, error-prone, more expensive and inefficient operation.

Some of the existing manufacturing utilizes automated production of brush bar pasted with felt but they fail to provide uniform pasting of the felt over brush bar.

In the view of foregoing, there is a need for an automated brush bar pasting machine. Further, there is a need for a brush bar pasting machine configured for uniform pasting of the felt over brush bar.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a machine and a method to minimize the labour required for manufacturing of an article used in surface treatment appliance.

It is another object of the present invention to provide a method and a machine to perform the manufacturing process in a consistent and continuous manner with minimal stoppages or required reworking so as to be commercially successful.

It is yet another object of the present invention to provide a versatile apparatus that can be upgraded for additional processing steps in future.

Accordingly, the present invention provides a method of manufacturing an article used in a surface treatment appliance. The method includes the steps of initiating a load operation by utilizing a felt strip feed-in system where a felt roller guide system implements the felt strip feed-in system while a mandrel guide of an article feed in system loads the article in a spiral rotational movement. The method further includes initiating an assembly operation to paste a felt strip to the article wherein a linear downward force of the mandrel guide and a rotational force from a main guide of the article generates a momentum that causes the felt strip to adhere to the article in a spiral or convoluted orientation, and initiating an unload operation wherein at least one sensor detects the end of a pasting process to trigger a cutter to detach the felt strip from its roll wherein a gripper is prompted to discharge the article.

In an embodiment, the present invention provides a machine for manufacturing an article used in a surface treatment appliance. The machine includes a base frame, an article feed-in system having a mandrel guide attached at a vertically top portion of the base frame, a felt feed-in system having a felt roller guide connected to one or more corners of the base frame. The machine includes an assembly system having a felt insert station for pasting a felt strip to the article wherein the felt strip is guided at an oblique angle to enable a uniform spiral pasting of the felt strip to the article and an article main guide attached vertically below the mandrel guide at the center of the base frame. The machine also

includes a detachment system having a cylinder housing a cutter to detach the felt strip from its roll. The system also includes a network of sensors having a first sensor activated when the pasting process is completing, causing the cutter to be extended, a second sensor that causes the cutter to be retracted once the felt is cut, and a third sensor configured to detect the completion of cutting and release of the article from a gripper.

In an advantageous aspect of the present invention, multiple processing steps are incorporated in a single machine. Further, the roller brush bar as an article is manufactured in an effective, efficient and commercially viable manner. Also, a single operator is used to manufacture the article within a short cycle time.

In another advantageous aspect, the manufacturing complexity of the machine is simplified. The invention uses felt rolls/bobbins instead of pre-cut strips as the latter would incur higher material costs due to additional supplier processing, require more storage space because of the semi-finished form and wastage due to higher offcuts.

In yet another advantageous aspect, a single processing station is used to simultaneously paste a plurality of felt strips, with different colors, texture or other physical features, on the article. This is a more efficient approach compared to the alternative of using multiple stations to paste one strip at a time.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings, wherein like reference numerals denote corresponding parts throughout the several views:

FIG. 1A illustrates a block diagram of the method and systems for manufacturing of an article used in a surface treatment appliance, according to an embodiment of the present invention.

FIG. 1B illustrates a perspective view of a brush bar pasting machine with the felt, according to an embodiment of the present invention.

FIG. 1C illustrates the front view of the soft roller brush bar, according to an embodiment of the present invention.

FIG. 2 shows a brush bar feed-in system, according to an embodiment of the present invention.

FIG. 3 illustrates a side view of a felt strip feed-in system, according to an embodiment of the present invention.

FIG. 4A & 4B illustrates the assembly system of the machine, according to an embodiment of the present invention.

FIG. 5A illustrated top view of a cutter as a detachment system, according to an embodiment of the present invention.

FIG. 5B illustrates top view of the cutter and gripper, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Various embodiments of the present invention provide a method of manufacturing an article used in a surface treatment appliance and a machine therefore.
In a related embodiment, the article is an automated roller brush bar for a surface treatment appliance like a vacuum cleaner and the invention is related to a machine and a method for manufacturing the same.

However, it will be apparent to those of ordinary skill in the art that the manufacturing method and machine, with modifications, could also be applied to equivalent parts in other surface treating appliances. The term “surface treating appliance” includes vacuum cleaners and other related appliances within the scope of the present invention. It extends to a wide range of appliances that are able to draw material from surfaces and machines which apply material to surfaces such as polishing machines, shampooing machines, packaging machines etc.

Referring to block diagram 100a in FIG. 1A, the present invention can be divided into three separate operations required to assemble the roller brush bar. The first operation is

to load the inputs namely the brush bar which forms the core, and the felt which makes up the covering. The second operation is the assembly of the roller brush bar whereby the felt strip is pasted or bonded to the brush bar surface. The third operation is to unload the finished product by using a cutting mechanism to sever the felt strip from the roll, producing a single roller brush bar.

The three operations described above are accomplished with various internal systems. A feed-in system consisting of two separate modules for the felt strip and the brush bar; an assembly system that combines the two inputs namely the brush bar and felt strip using a pasting process; and the detect, detach and discharge system that utilizes a detection sensor to detach the strip from the felt roll, thereby producing a single roller brush bar.

In an embodiment, the load operation has two separate feed-in systems. The felt strip feed-in is implemented by the felt roller guide system while the mandrel guide guides the brush bar in a spiral rotational movement.

In another embodiment, the assembly operation includes pasting of the felt strip to the brush bar to form the article. This is achieved through the momentum generated by the linear downward force of the mandrel guide and the rotational force from the main guide station that causes the felt strip to adhere to the brush bar in a spiral or convoluted orientation.

In yet another embodiment, the unload operation has three parts. Once the sensor detects the end of the pasting process, the cutter is triggered to detach the felt strip from its roll. The cutting is realized in a high speed multi-stroke motion. The completion of the cutting prompts the gripper to discharge the finished roller brush bar.

FIG. 1B illustrates a perspective and side view of a brush bar pasting machine with the felt, according to one embodiment of the present invention. With respect to FIG. 1B, the machine (100b, 100c) comprises a base frame (101), a mandrel guide (102), a felt roller guide stations (103), a felt insert station (104), a brush bar main guide (105), a cutting station (106) and at least one felt roller (107). The mandrel guide (102) is attached vertically to the top portion of the base frame (101). The felt roller guide stations (103) are located at the four corners of the base frame (101). The brush bar main guide (105) is

vertically below the mandrel guide 102, at the center of the base frame (101). The cutting station (106) is horizontally below an assembly station of the brush bar main guide (105). As shown in Fig. 1C the brush bar includes at least one slot 108 (108a, 108b) for accommodating the brush strip. The felt is pasted on the surface of the brush bar/ core (109).

Fig. 2A & 2B illustrates the feed-in system (200a, 200b) for the brush bar. It consists of the mandrel guide (201) and at least one sensor (202). The mandrel guide (201) is a shaft attached vertically at the top of the base frame driven by a pneumatic cylinder. The brush bar (204) is pushed downward in a spiral motion through the guide cylinder (205) with the mandrel (203) at the top and the mandrel (208) from the preceding brush bar at bottom. To enable continuous pasting, the alignment of the individual incoming and outgoing brush bars in the assembly station is important. If the brush bars are not rotated correctly relative to each other, the felt strip will be pasted incorrectly in succeeding articles. The feed-in mechanism is designed to enable the smooth feed-in of successive brush bars and the activation of continuous felt strip pasting without any interruption. The brush bar (204) includes slots (206). The machine has guide pins constructed in the inner walls (207a, 207b).

According to one embodiment of the present invention, the brush bar is automatically loaded through the brush bar mandrel guide. In addition, the brush bar could be rotated to enable the wrapping material to adhere to it. A screw or helical motion driven by a motorized system could be used to accomplish the automated control required.

FIG. 3 illustrates the feed-in system (300) for the felt strip. It consists of a felt roller guide. In the present embodiment, there are four felt rollers in the machine. The felt roller guides are located at each corner of the base frame. The roller guide consists of a pair of unwinding guide rollers (301), a stripper roller (302), a feed-in roller (303) and a felt roller (304). The pair of unwinding rollers (301) maintain the tension of the unwound felt strip and prevents the strip wrinkling or crimping. The felt strip in the present embodiment uses a double-sided tape as the adhering agent. The adhesive face (305) is protected with a liner (306). The stripper roller (302) removes the liner to expose the adhesive film. The feed-in roller (303) controls the oblique angle of the feed-in according to the spiral

rotation of the brush bar. The roller guide system is critical to ensuring a uniform felt coverage over the brush bar.

According to one embodiment of the present invention, the brush bar main guide houses a packaging mechanism. The packaging mechanism senses a brush bar of a predetermined length and activates a felt insertion through the felt roller guide.

According to one embodiment of the present invention, additional stations such as direct adhesive dispensing, or heat treatment could be added to the felt stations.

FIG 4A & FIG 4B illustrates the assembly system (400a, 400b). The assembly system consists of a base (401), a brush bar main guide (402) and a felt insert stations (403). The brush bar main guide is attached vertically below the mandrel guide (404). The felt insert station (403) are the four corners; one for each roller guide system. The felt insert station (403) supports and directs the felt strip at an oblique angle from the feed-in roller to the assembly zone.

The main guide (402) enables the pasting of the felt strip to the brush bar (406). The continuous spiral or convoluted pasting of successive brush bars is based on using a series of guide pins protruding from the inner wall of the main guide (402). The top guide pins and middle guide pins are located inside the mandrel guide cylinder. The bottom guide pins are inside the brush bar main guide that is on a platform of the base frame (401).

The pasting is driven by the momentum generated from the downward and rotational forces exerted on the brush bar. Once part of the felt strip adheres to the brush bar, the downward motion pulls the remainder of the felt strip towards the brush bar, and triggers the unwinding of the felt from the roll. The felt strip (407) is pasted in a spiral or convoluted formation along the brush bar body in feed system (408), as shown in FIG. 4B.

FIG. 5A illustrates the top view of the detachment system (500a) and in accordance with an embodiment of the invention. The system (500a) consists of a pneumatic cylinder (501), cutter blade (502) with at least two cutting edge (502a, 502b), a pointed edge (502c) and a network of sensors 503 (503a, 503b) linked to a programmable logic controller.

FIG. 5B provides perspective view (500b) of cutter and gripper in accordance with an embodiment of the invention.

The invention has four detachment stations. The exit sensor at the assembly stage detects the end of the pasting process. The brush bar is positioned at the cutting station with a gripper (504) holding it. This triggers the pneumatically powered cutter (502). The V-shaped cutter (502) severs each felt strip from its roll. The pointed end (502c) creates a tear in the center while the edges (502a, 502b) slit the felt apart. When the cutting stroke is completed, a sensor (503) triggers the retraction of the cutter (502). The sensor (503b) beneath the cutting station detects the completion of the cutting stage and triggers the gripper (504) to discharge the finished roller brush bar (407).

As will be readily apparent to those skilled in the art, the present invention may easily be produced in other specific forms without departing from its essential characteristics. The present embodiments are, therefore, to be considered as merely illustrative and not restrictive, the scope of the invention being indicated by the claims rather than the foregoing description, and all changes which come within the scope are therefore intended to be embraced therein.

Although the embodiments herein are described with various specific embodiments, it will be obvious for a person skilled in the art to practice the invention with modifications. However, all such modifications are deemed to be within the scope of the appended claims.

CLAIMS

1. A method of manufacturing an article used in a surface treatment appliance comprising the steps of:

initiating a load operation by utilizing felt strip feed-in system wherein a felt roller guide system implements the felt strip feed-in system while a mandrel guide of an article feed in system loads the article in a spiral rotational movement;

initiating an assembly operation to paste felt strip to the article wherein a linear downward force of the mandrel guide and a rotational force from a main guide of the article generates a momentum that causes the felt strip to adhere to the article in a spiral or convoluted orientation; and

initiating an unload operation wherein at least one sensor detects end of a pasting process to trigger a cutter to detach the felt strip from its roll wherein a gripper is prompted to discharge the article.

2. The method as claimed in claim 1 wherein the cutting is realized in a high speed multi-stroke motion.

3. The method as claimed in claim 1 wherein the article is a roller brush bar.

4. The method as claimed in claim 1 further comprises attaching, fixing, bonding, pasting or adhering of a fabric, textile, film or tape along an entire or partial length of a cylindrical or planar exterior of the article used in a surface treatment appliance.

5. A machine (100a) for manufacturing an article (406) used in a surface treatment appliance, the machine comprising:

a base frame (101, 401);

an article feed-in system having a mandrel guide (102, 404) attached at a vertically top portion of the base frame (101, 401);

a felt feed-in system (300) having a felt roller guide (103) connected to one or more corners of the base frame (101, 401);

an assembly system (400) having a felt insert station (104) for pasting a felt strip to the article (406) wherein the felt strip is guided at an oblique angle to enable a uniform spiral pasting of the felt strip to the article (406); and

an article main guide attached vertically below the mandrel guide (102, 404) at center of the base frame (101, 401);

a detachment system (500a) having a cylinder housing a cutter (502) to detach the felt strip from its roll; and

a network of sensors (202, 503 (503a, 503b)) having a first sensor activated when pasting process is completing, causing the cutter to be extended, a second sensor that causes the cutter (502) to be retracted once the felt is cut, and a third sensor configured to detect completion of cutting and release of the article from a gripper (504).

6. The machine as claimed in claim 5 wherein the article (406) is a roller brush bar.

7. The machine as claimed in claim 6 wherein the brush bar (406) is pushed through the brush bar felt mandrel guide (102, 404), wherein the brush bar mandrel orientates the brush bar using guide pins in an inner wall of the mandrel guide (102, 404).

8. The machine as claimed in 6 wherein the brush bar (406) is guided through the mandrel guide (102, 404) using a motorized system to enable downward motion and rotation of the brush bar (406).

9. The machine as claimed in claim 6, wherein the felt strip is guided through a set of rollers (301, 302, 303) configured to unwind the felt strip, maintain roll tension to prevent wrinkling of the felt strip, remove liner from the felt strip to expose the adhesive face and feed-in the felt strip in an oblique angle towards the assembly system.

10. The machine as claimed in claim 9 wherein the set of rollers (301, 302, 303) are used to feed-in fabrics, textiles, tapes and films required to be fixed, bonded, pasted or adhered to a curvilinear or planar core surface at perpendicular, parallel or oblique angles.

11. The machine as claimed in claim 10, wherein each of the rollers (301, 302, 303) is used to simultaneously feed-in to the assembly system a plurality of fabrics, textiles,

tapes or films differing in color, texture or physical dimensions to manufacture the brush bar.

12. The machine as claimed in claim 6 wherein the assembly system uses a downward force and a rotational force to drive the brush bar, adjusting its orientation with protruding or depressed slot guides based on "poka yoke" principles and simultaneously unwinding the felt strip that subsequently adheres to the brush bar.

13. The machine as claimed in claim 12 wherein the assembly system uses a motorized system to drive the brush bar into assembly block and simultaneously unwind the felt strip that adheres to the brush bar.

14. The machine as claimed in claim 13 wherein the assembly system enables uniform pasting of felt strip.

15. The machine as claimed in claim 6, wherein the brush bar main guide houses a packaging mechanism, wherein the packaging mechanism senses a brush bar of a predetermined length and activates a felt insertion through the felt roller guide.

16. The machine as claimed in claim 5 further comprises a discharge system (500a) having the network of sensors (202, 503 (503a, 503b)) linked to a PLC.

17. The machine as claimed in claim 16 wherein the discharge system (500a) is hardwired, or coded with various programming languages or customized computer software.

18. The machine as claimed in claim 5 further comprises additional stations such as direct adhesive dispensing or heat treatment.

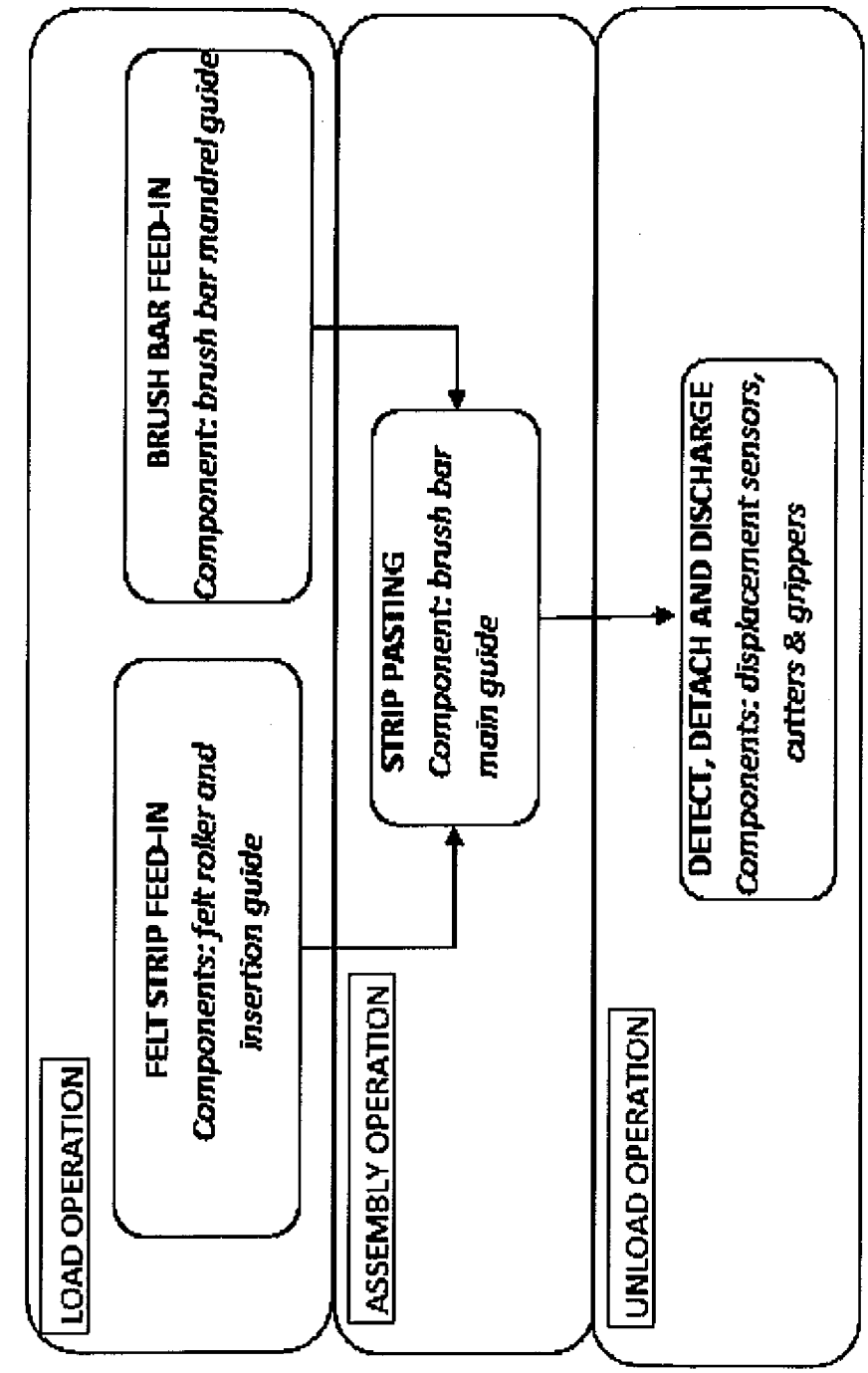
100a
LOAD OPERATION
FELT STRIP FEED-IN
Components: felt roller and insertion guide
BRUSH BAR FEED-IN
Component: brush bar mandrel guide
ASSEMBLY OPERATION
STRIP PASTING
Component: brush bar main guide
UNLOAD OPERATION
DETECT, DETACH AND DISCHARGE
Components: displacement sensors, cutters & grippers

FIG. 1

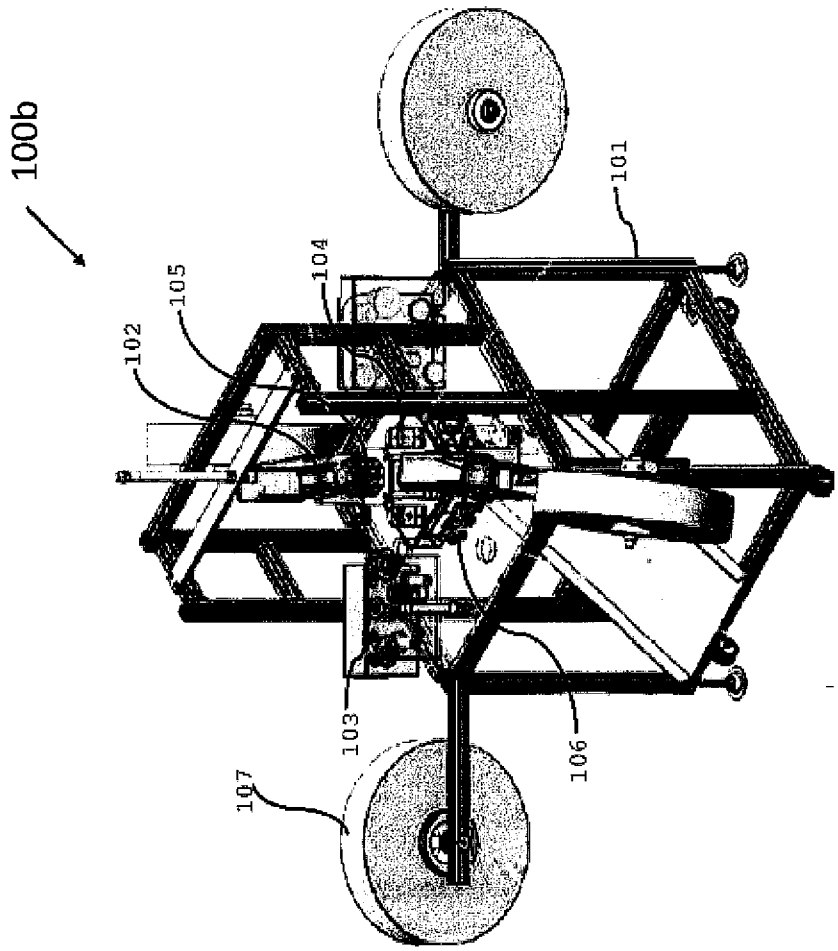

FIG. 1B

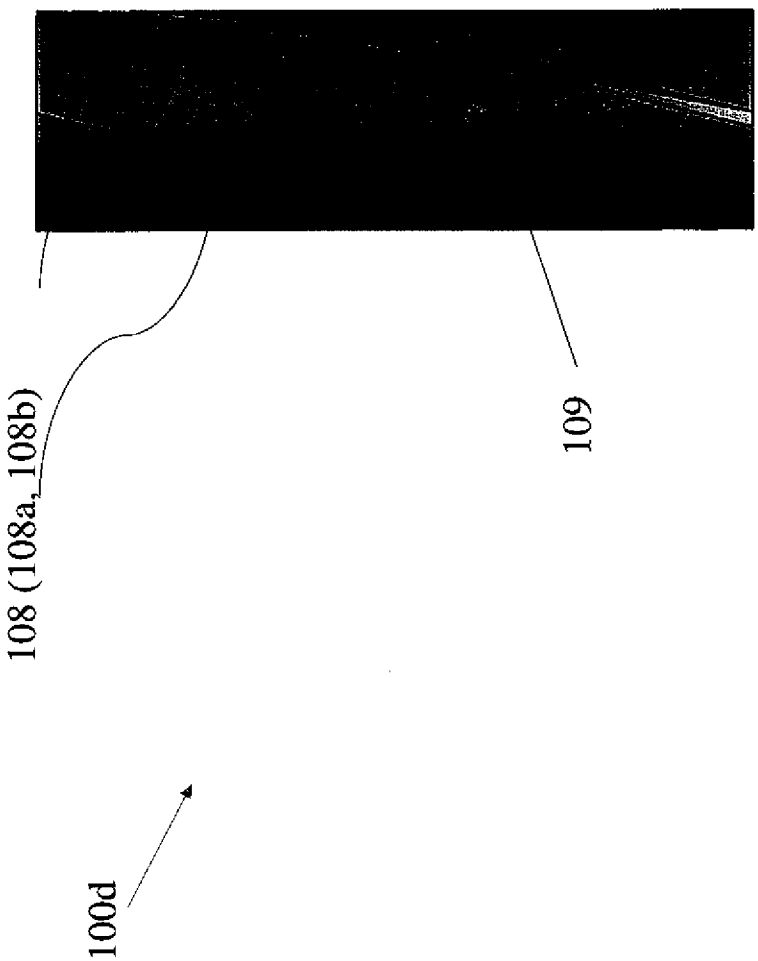

FIG 1C

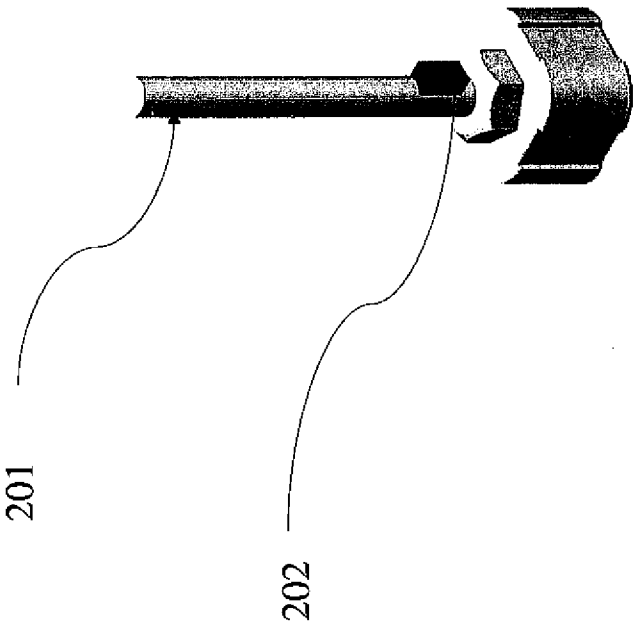

FIG 2A

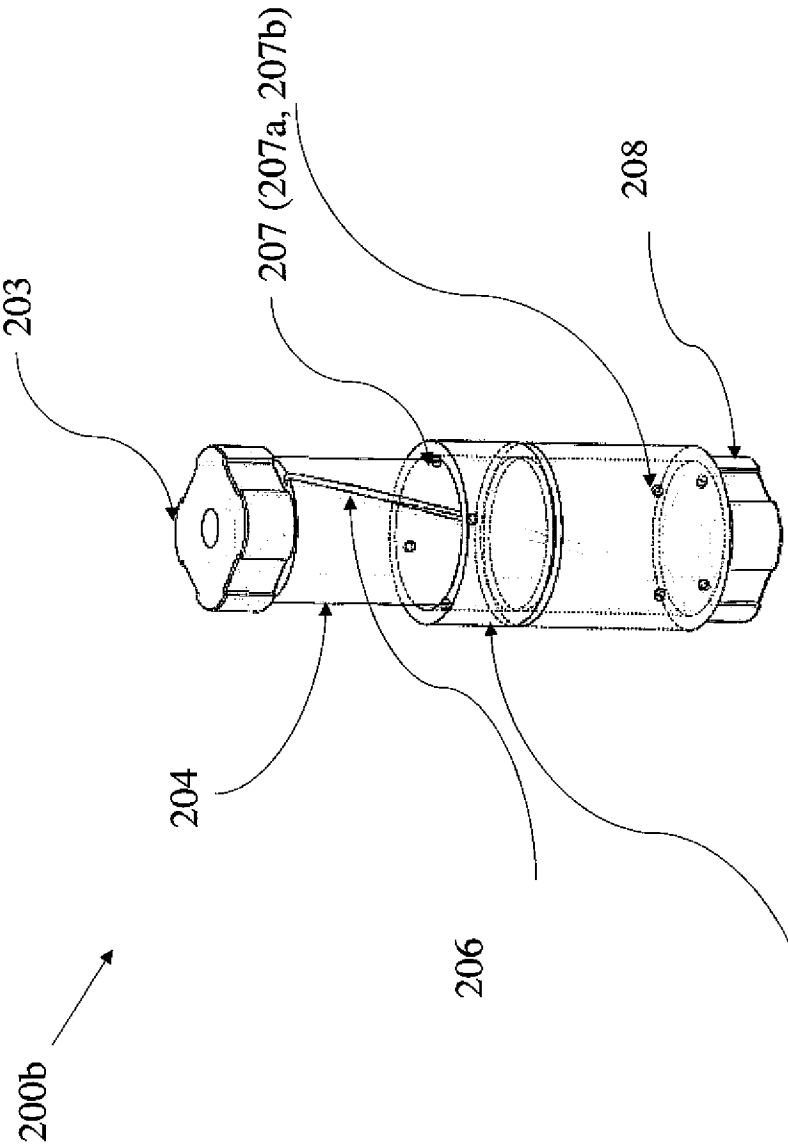

FIG 2B

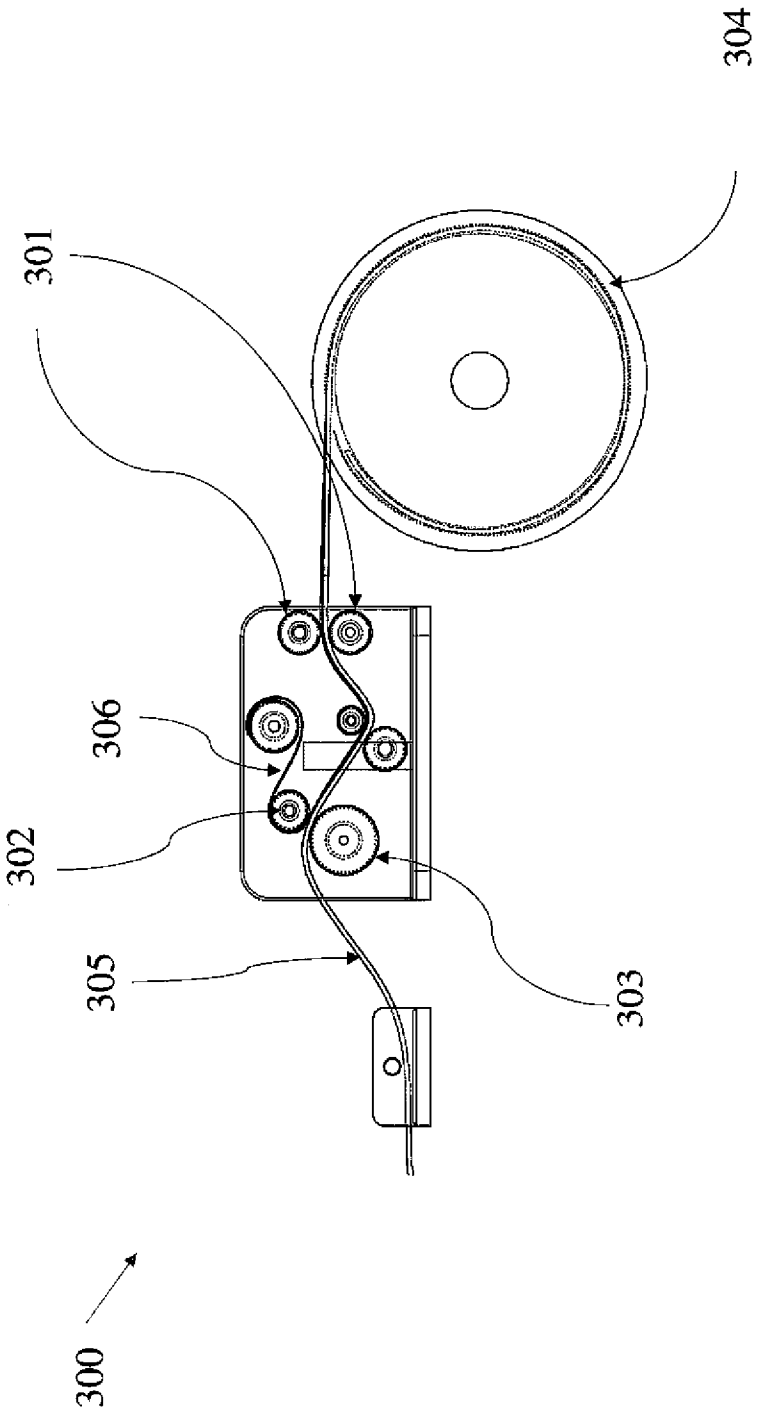

FIG 3

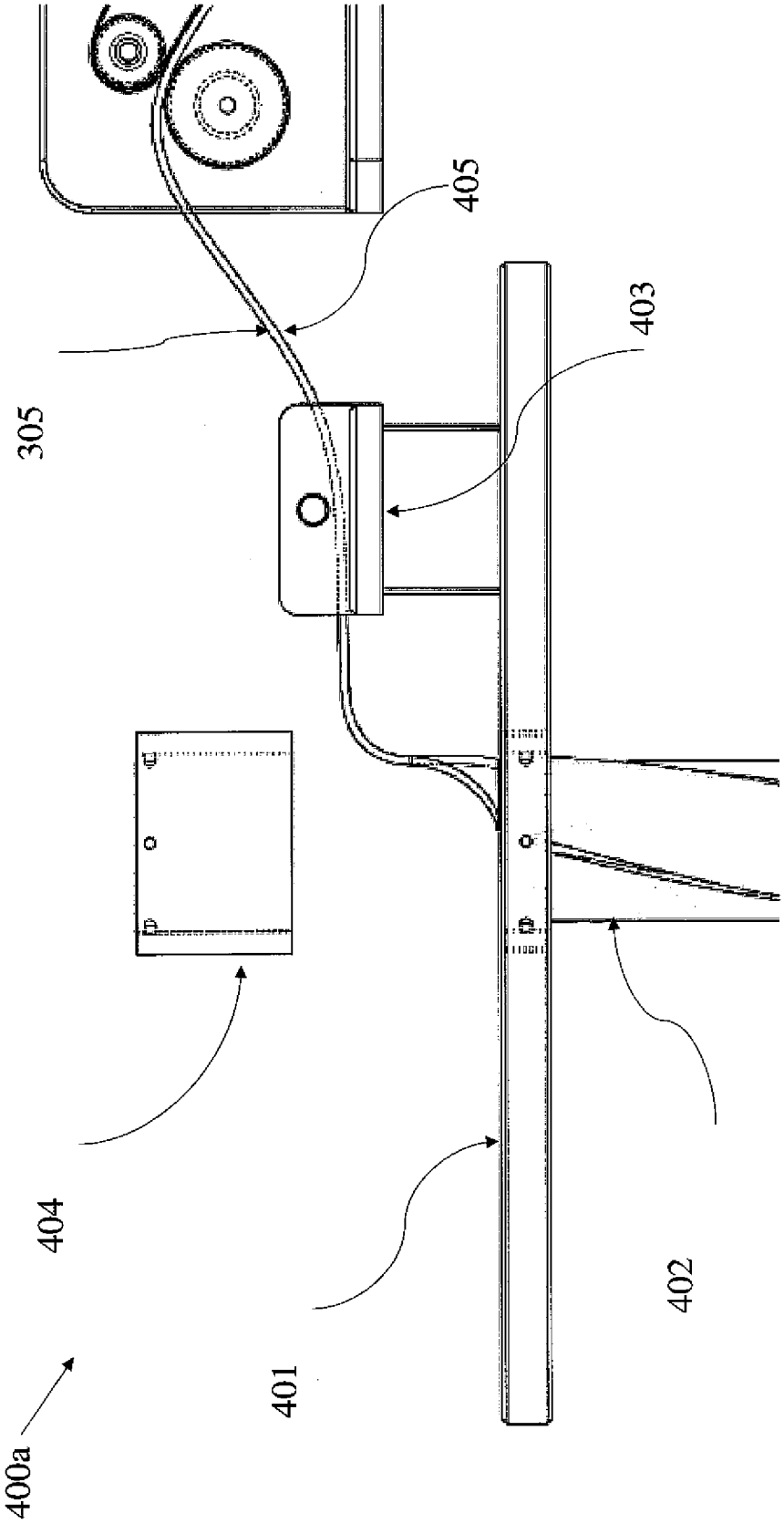

FIG 4A

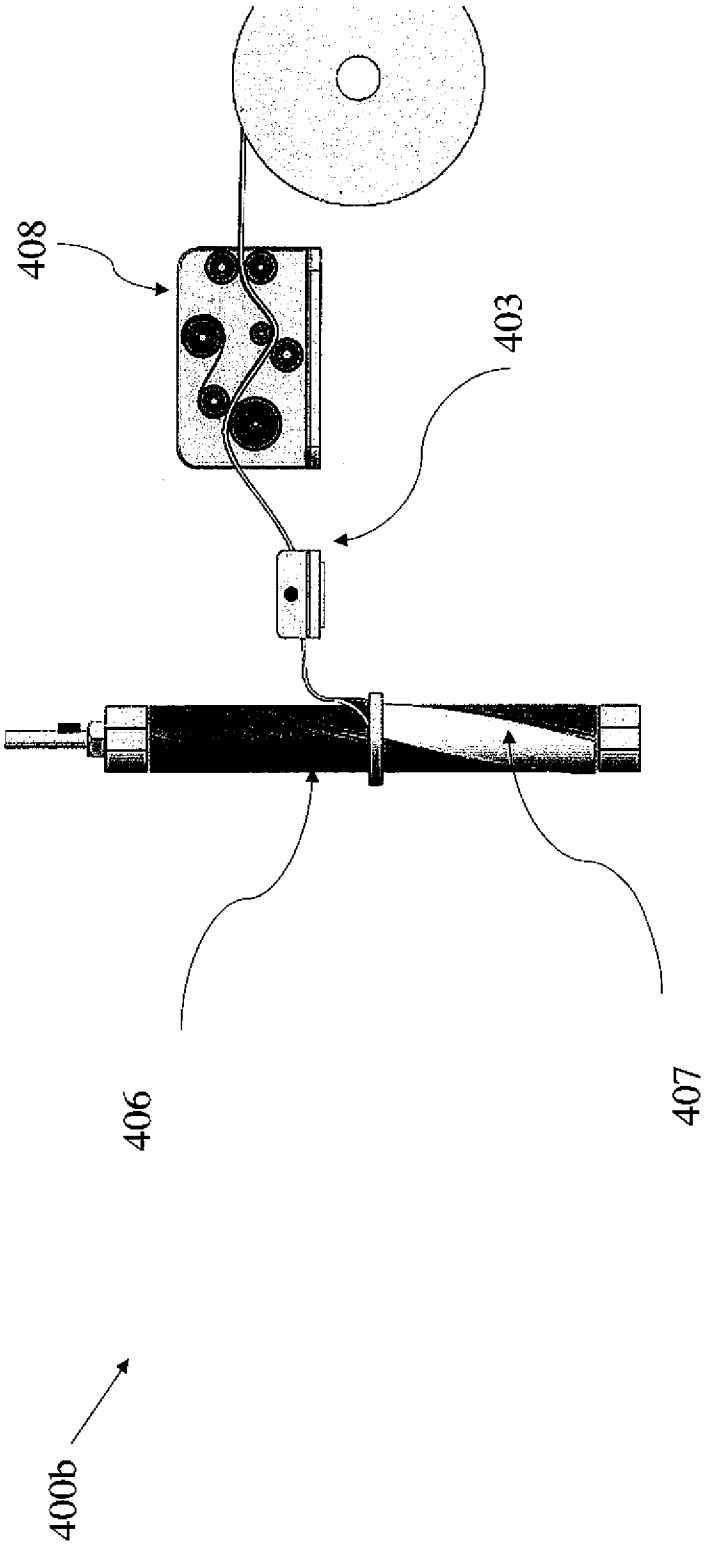

FIG. 4B

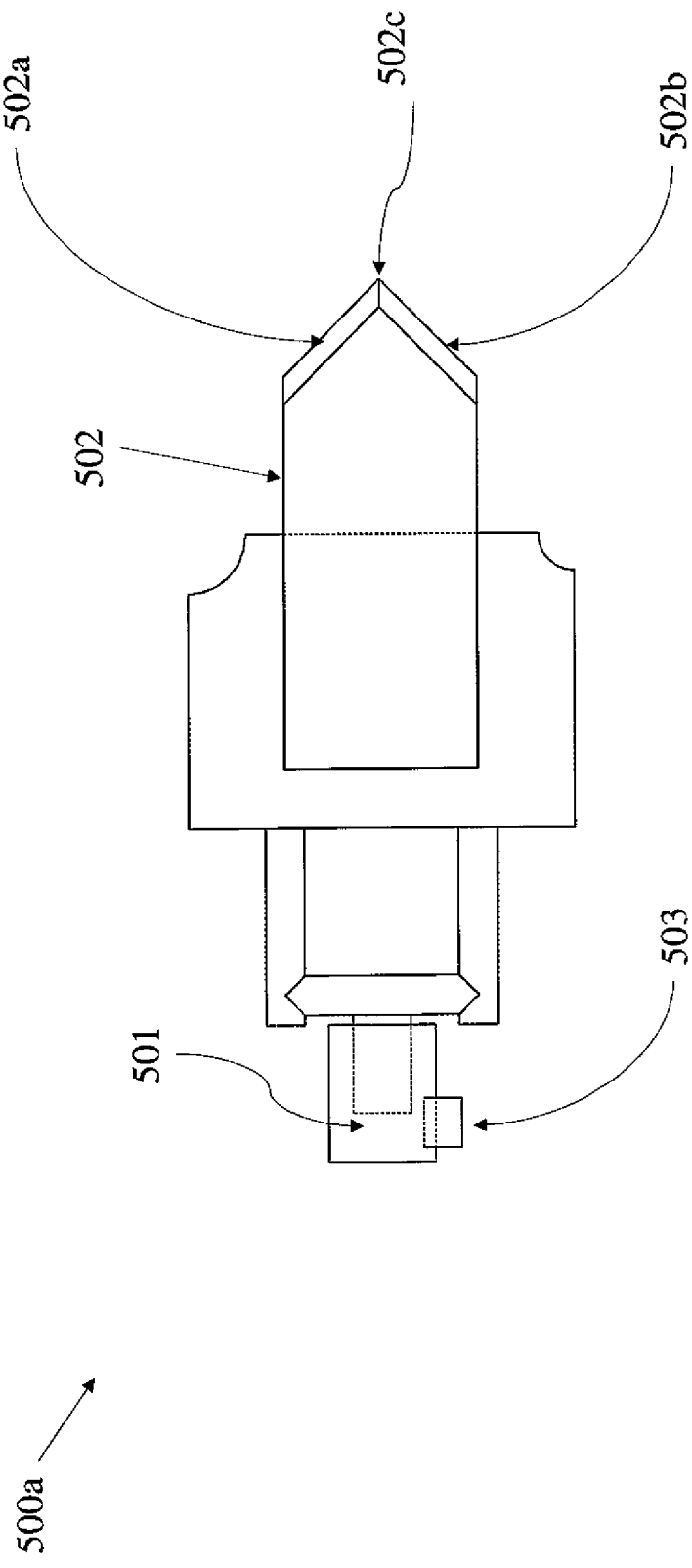

FIG. 5A

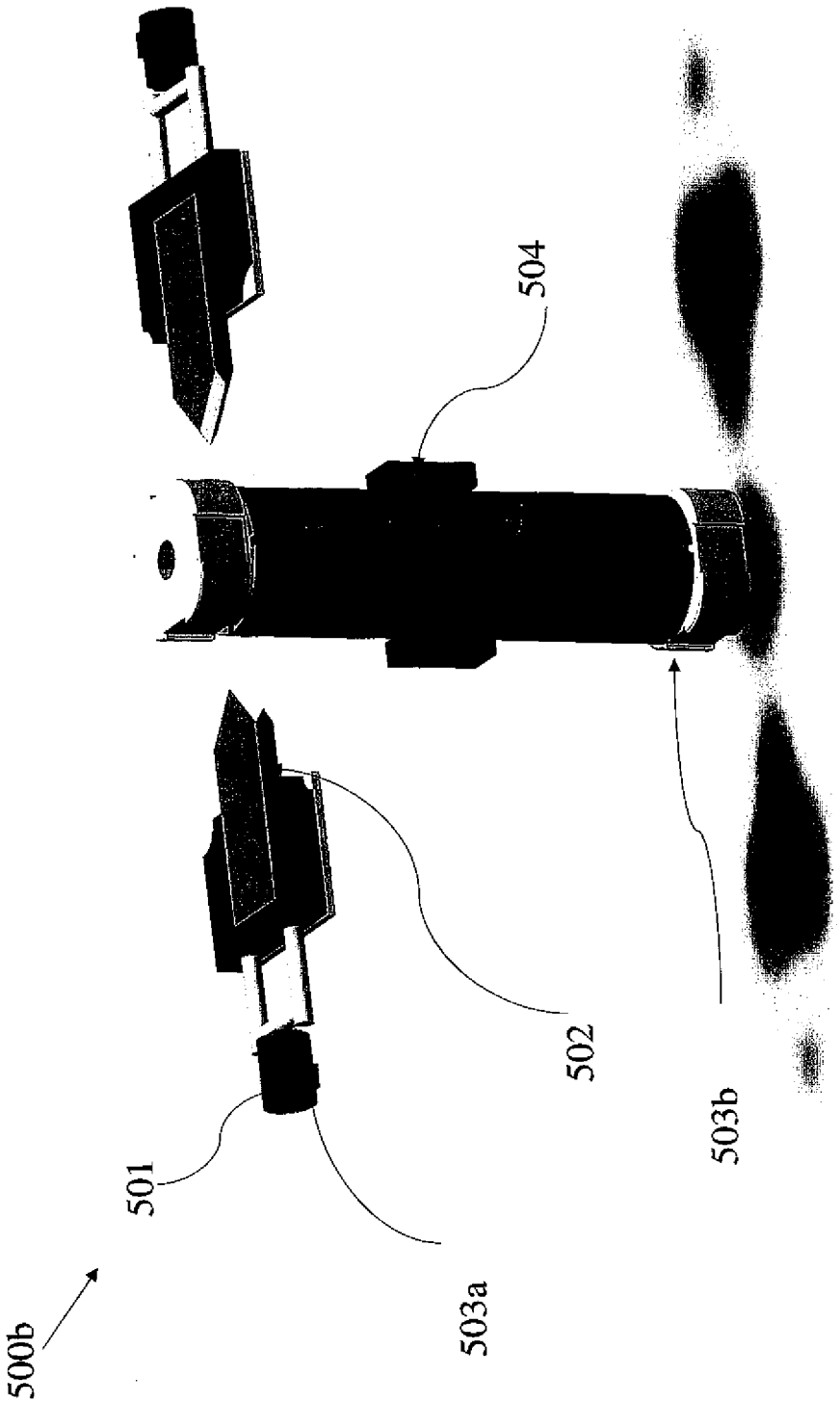

FIG. 5B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2019/050005

A. CLASSIFICATION OF SUBJECT MATTER

A46B 13/00 (2006.01) A46B 9/02 (2006.01) A46D 3/00 (2006.01) B65H 81/08 (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)

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)

PATENW, IPC/CPC: A46B9/00, A46B9/02, A46B9/005, A46B13/00, A46B13/006, A46D3/00, A47L5/30, A47L9/0477, A47L11/4041, B29C63/14, B29C31/002, B65H81/00, B65H81/08 & Keywords: paste, attach, wrap, glue, adhesive, self-adhesive, self-adhering, adhesive-felt, strip, roll, tape, band, spiral, wound, convolute, brush, bar, rotary, body, core, tube, collar, ring, sleeve, felt, fabric, fiber, sensor, detect, end, cut, release, guide, feed, force, initiate and like terms.

Applicant/inventor name search in Espacenet, Auspat and IP Australia internal database.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

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

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"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
10 April 2019	10 April 2019
Name and mailing address of the ISA/AU	**Authorised officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	John Ho AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262832329

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/MY2019/050005**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/160138 A1 (LEE FOOK YUEN) 21 September 2017 Figures 1-4, page 3 line 5 - page 5 line 25.	1-6, 8-11, 15-18
A	GB 2148238 A (EDWARD JACKSON (ENGINEER) LIMITED (UK)) 30 May 1985 Figures 1A-2B, page 1 line 55 - page 3 line 96	1-11, 15-18
A	US 3555976 A (CHARLES I. CARTER et al.) 19 January 1971 Figure 1.	1-11, 15-18
A	US 4627127 A (DUPRE) 09 December 1986 Figures 1-3	1-11, 15-18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2019/050005

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:

because they relate to subject matter not required to be searched by this Authority, namely:

the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including

2. ☒ Claims Nos.: **12-14**

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

See Supplemental Box

3. ☐ Claims Nos:

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box for Details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT	International application No. PCT/MY2019/050005

Supplemental Box

Continuation of **Box II**

Claims 12-14 do not comply with PCT Article 6 because the feature of "*adjusting its orientation with protruding or depressed slot guides based on poka yoke principle*" has not been described nor embodied in the description. Further, the scope of these claims including this feature is indeterminate because it is not known what "*poka yoke principle*" encompasses, nor is it made clear how such principle enables orientation of the brush bar to be adjusted.

Continuation of: **Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1-4 are directed to a method of manufacturing an article used in a surface treatment appliance. The feature of initiating a load operation using a felt strip feed-in system including a felt roller guide and a mandrel guide for feeding felt strip and feeding the article in a spiral rotational movement, initiating an assembly operation to paste felt strip to the article whereby linear downward force of the mandrel guide and rotational force from a main guide generates a momentum to cause the felt strip to adhere to the article in a spiral or convoluted orientation; and initiating an unload operation wherein at least one sensor detects end of the pasting process to trigger a cutter to detach the felt strip and to discharge the article using a gripper is specific to this group of claims.

- Claims 5-18 are directed to a machine for manufacturing an article for a surface treatment appliance. The feature of a machine including a base frame, an article feed-in including a mandrel guide, a felt feed-in system including a felt roller guide connected to one or more corners of the base frame, an assembly system including a felt insert station for pasting and guiding the felt strip at an oblique angle to enable uniform spiral pasting, an article main guide, a detachment system including a cylinder housing a cutter to detach the felt strip from its roll and a network of sensors including first, second and third sensors for activating the cutter to be extended after the pasting process, causing the cutter to be retracted after the cutting operation and to detect completion of the cutting and release of the article from a gripper is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is loading felt strip using felt strip feed-in system including a felt roller guide and a mandrel guide, pasting and adhering the felt strip to the article in a spiral orientation using the mandrel and main guide, and detaching the article using at least one sensor to detect the end of the pasting process to trigger a cutter to cut the felt strip whereby a gripper is used to discharge the article

However this feature does not make a contribution over the prior art because it is disclosed in:

D1 - WO 2017/160138 A1 (LEE FOOK YUEN) 21 September 2017 (see felt roller - 103, mandrel guide - 102, main guide - see the cylindrical opening in insert felt holder 104, a sensor to detect the end of the pasting process and to initiate cutting of the felt strip - page 5 lines 4-6, and a gripper to discharge the article - see cylinder 106).

Therefore in the light of this document this common feature cannot be a special technical feature. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/MY2019/050005**

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

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
WO 2017/160138 A1	21 September 2017	WO 2017160138 A1	21 Sep 2017
		CN 109068842 A	21 Dec 2018
		PH 12017501779 A1	02 Apr 2018
GB 2148238 A	30 May 1985	GB 2148238 A	30 May 1985
		GB 2148238 B	25 Jun 1986
US 3555976 A	19 January 1971	US 3555976 A	19 Jan 1971
US 4627127 A	09 December 1986	US 4627127 A	09 Dec 1986
		EP 0215803 A1	01 Apr 1987
		EP 0215803 B1	11 Oct 1989
		JP S62501819 A	23 Jul 1987
		JP 2510175 B2	26 Jun 1996
		WO 8604792 A1	28 Aug 1986

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.