US012391018B2

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Baker et al.

(10) **Patent No.: US 12,391,018 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **SYSTEMS AND METHODS FOR PACKAGING INSTRUMENTS OR OTHER ITEMS WITH BAG MAKING FEATURES**

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(73) Assignee: **RST AUTOMATION LLC**, Bronx, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

(21) Appl. No.: **17/225,839**

(22) Filed: **Apr. 8, 2021**

(65) **Prior Publication Data**

US 2021/0316523 A1 Oct. 14, 2021

Related U.S. Application Data

(60) Provisional application No. 63/008,277, filed on Apr. 10, 2020.

(51) **Int. Cl.**

B31B 70/00	(2017.01)
B31B 70/02	(2017.01)
B31B 70/10	(2017.01)
B31B 70/16	(2017.01)
B31B 70/64	(2017.01)

(Continued)

(52) **U.S. Cl.**

CPC ***B31B 70/006*** (2017.08); ***B31B 70/024*** (2017.08); ***B31B 70/10*** (2017.08); ***B31B 70/16*** (2017.08); ***B31B 70/642*** (2017.08); ***B31B 70/94*** (2017.08); *B31B 2155/003* (2017.08); *B31B 2241/00* (2013.01)

(58) **Field of Classification Search**

CPC B31B 70/006; B31B 70/024; B31B 70/94; B31B 70/642; B31B 70/10; B31B 70/16; B31B 2155/003; B31B 2241/00

USPC 493/186

See application file for complete search history.

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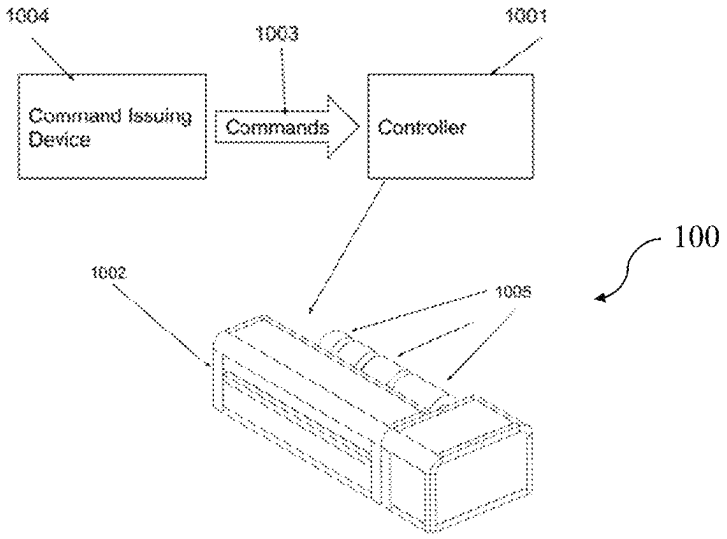
Primary Examiner — Sameh Tawfik
(74) *Attorney, Agent, or Firm* — ArentFox Schiff LLP

(57) **ABSTRACT**

A bagmaker interoperable with an item processor is disclosed, the bagmaker being configured to produce bags for packaging items for sterilization, such as medical instruments. The bagmaker may include a controller interoperable with a bag production device, the bag production device including a bag cutter and a heat sealer, such that tubing may be sealed and cut, such that a bag of a specified length is formed. Operation of the bagmaker may include identifying tubing corresponding to a bag width of the bag, advancing tubing to correspond with the length of the bag, sealing at least a first end of the tubing, and then advancing and cutting the tubing; ejecting the bag from the bagmaker and retracting remaining uncut tubing, wherein the retraction and ejection may occur contemporaneously or interchangeably in order.

21 Claims, 34 Drawing Sheets



(51) **Int. Cl.**
B31B 70/94 (2017.01)
B31B 155/00 (2017.01)

(56) **References Cited**

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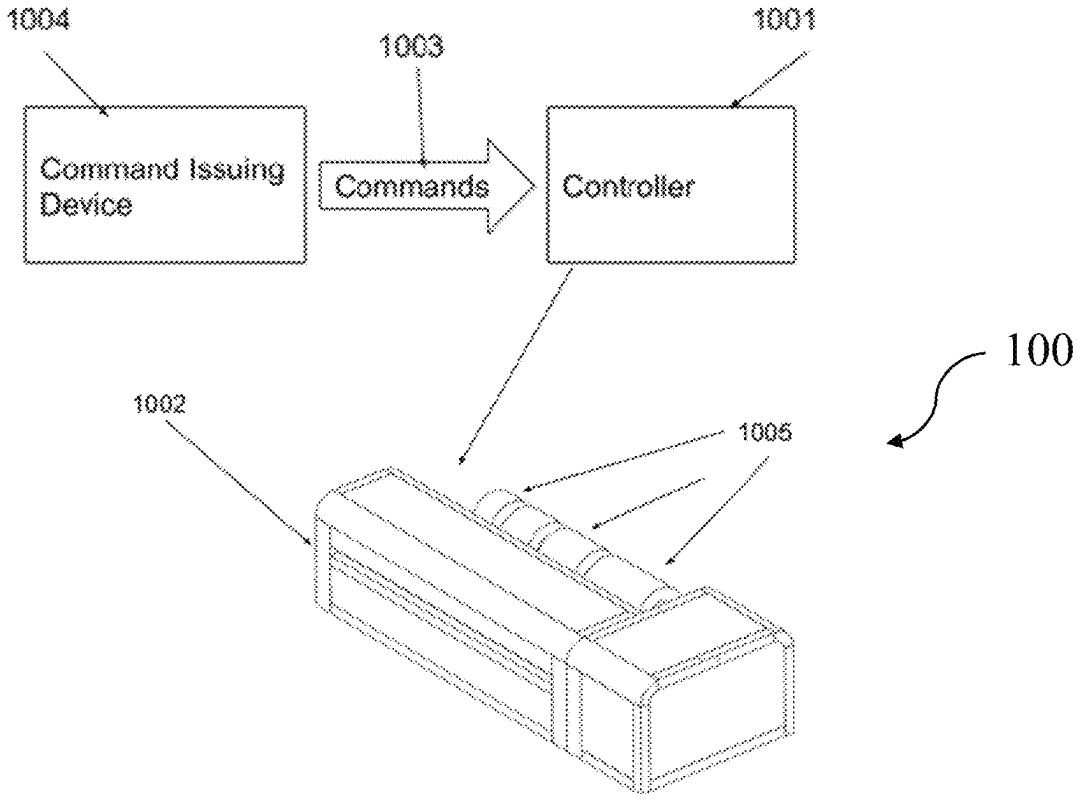

1004
1003
1001
Command Issuing Device
Commands
Controller
100
1002
1005

FIG. 1

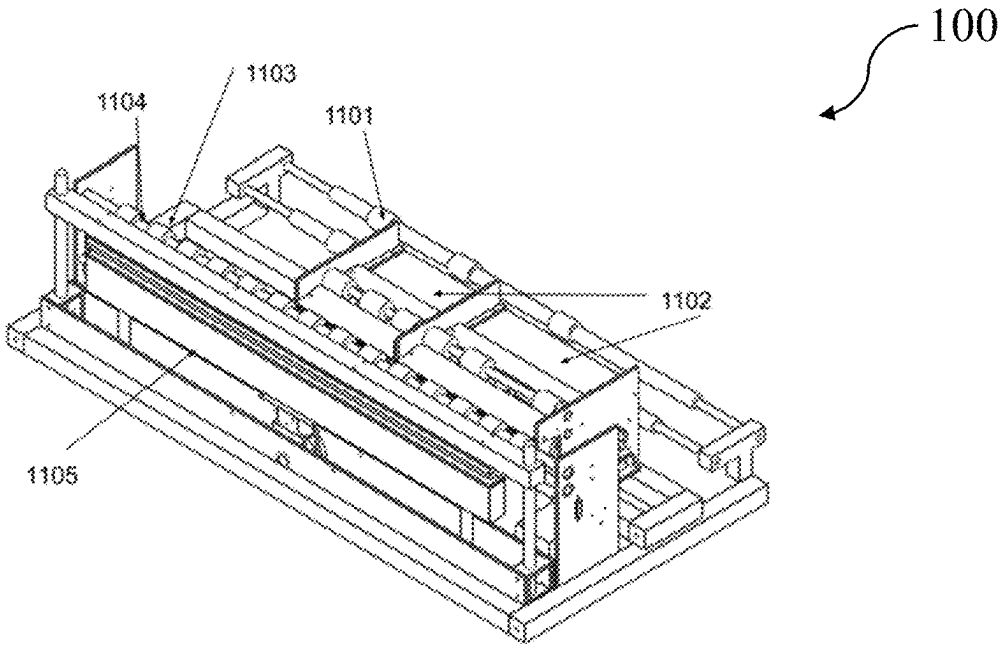


FIG. 2

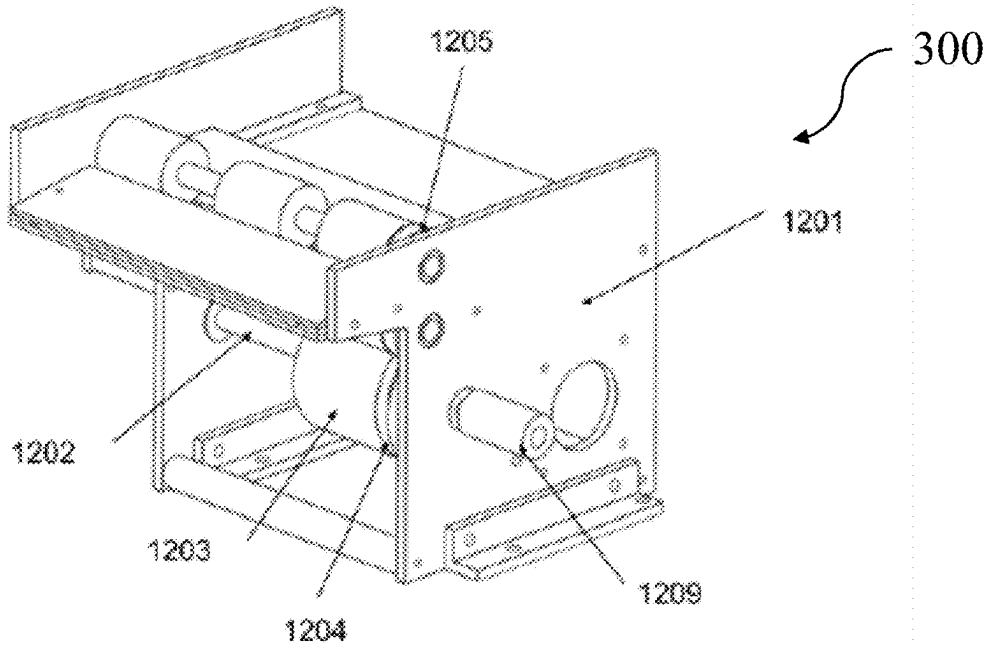


FIG. 3A

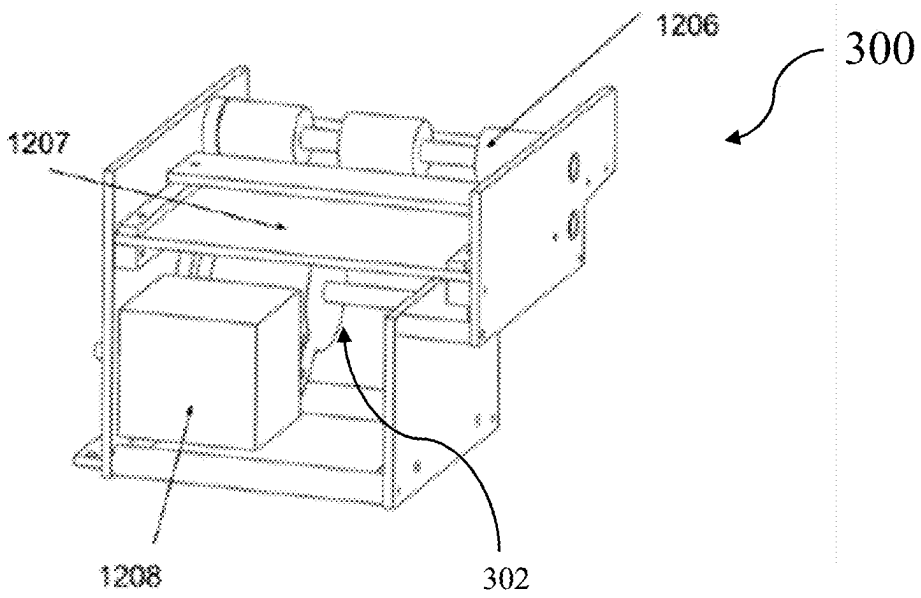


FIG. 3B

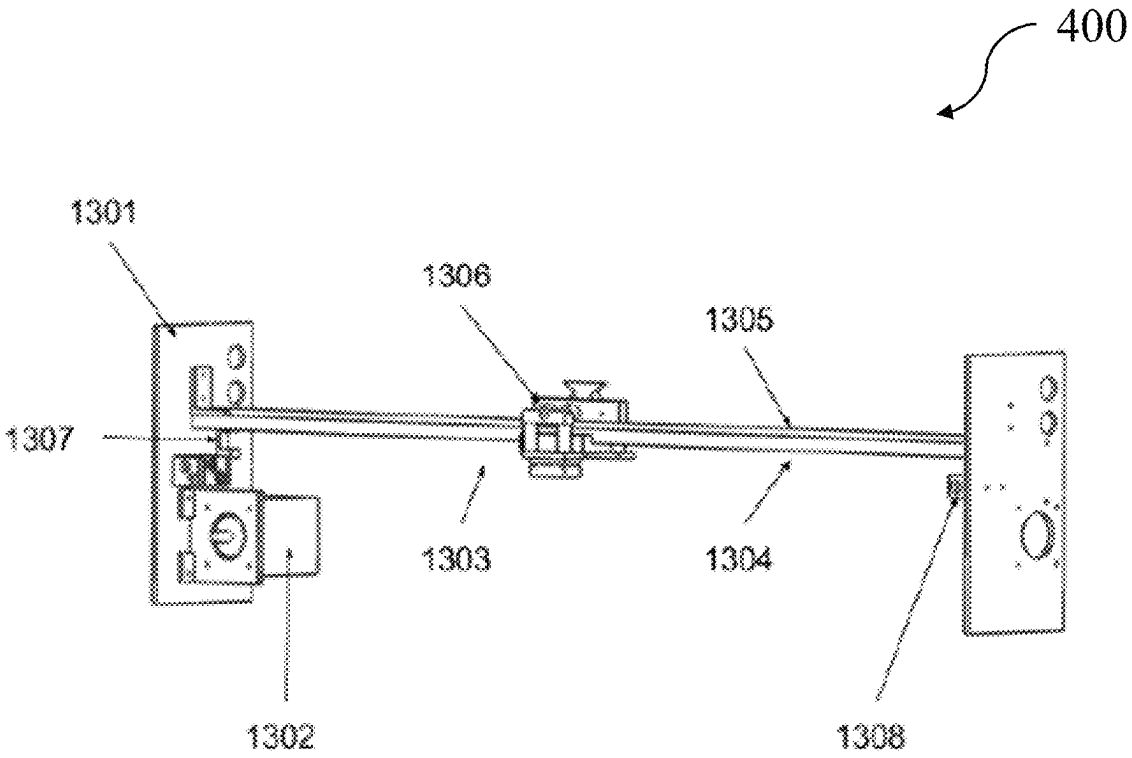


FIG. 4

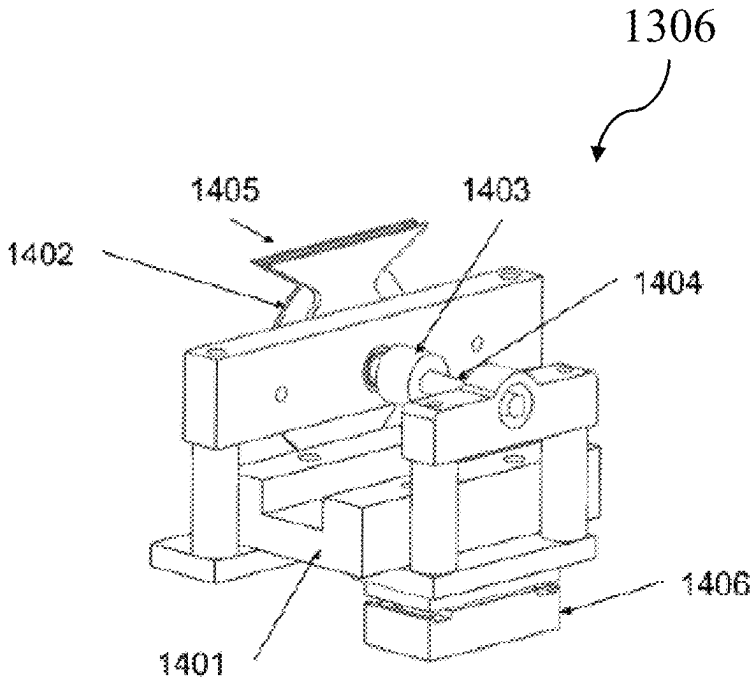


FIG. 5

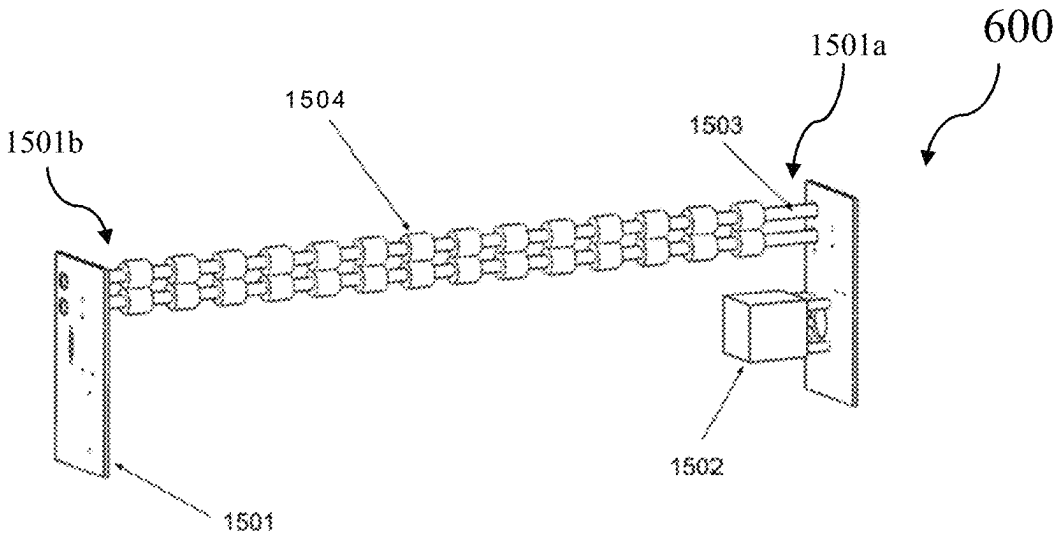


FIG. 6

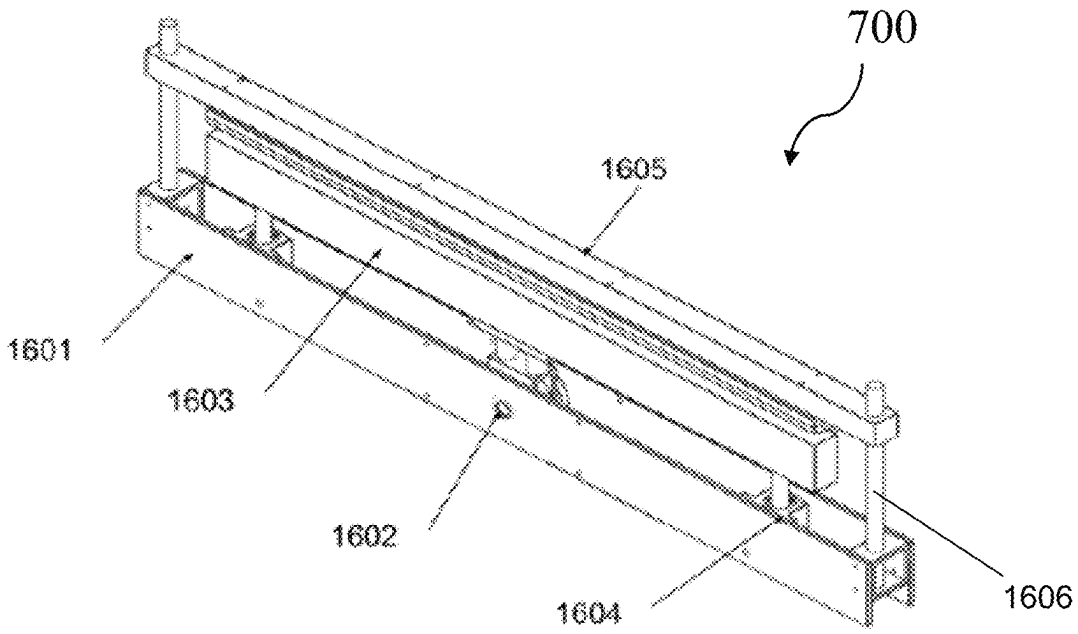


FIG. 7

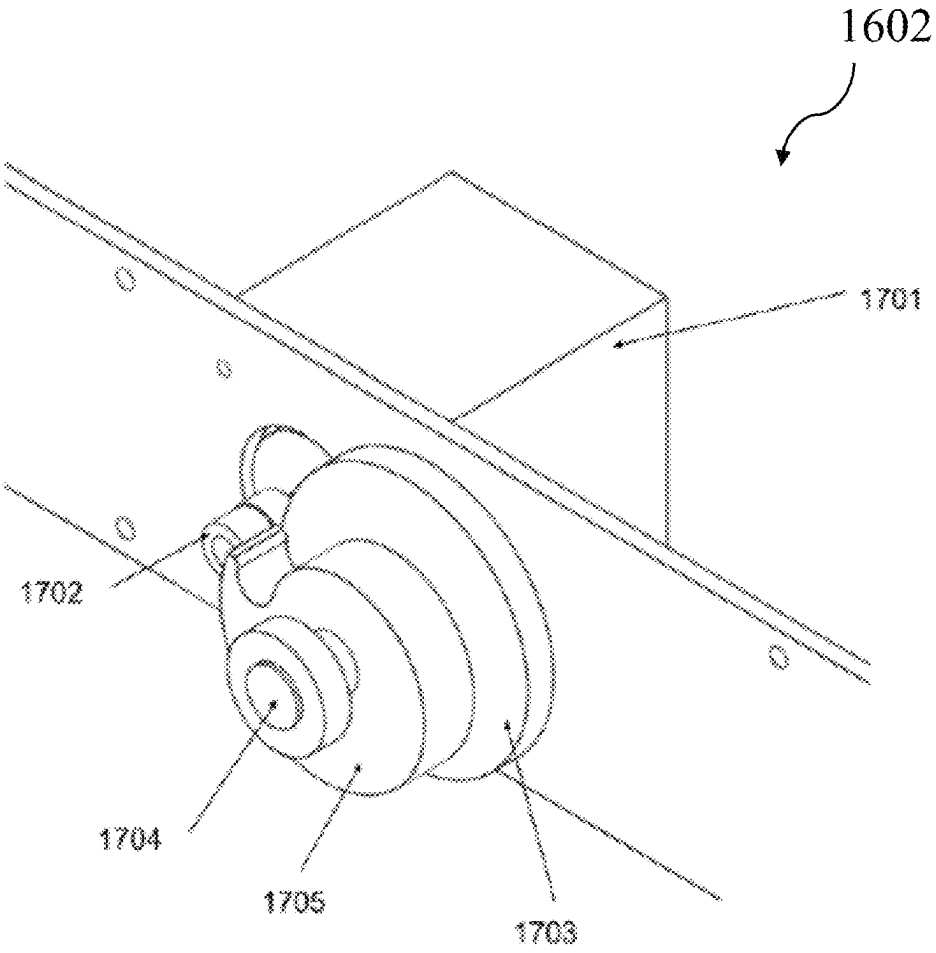


FIG. 8

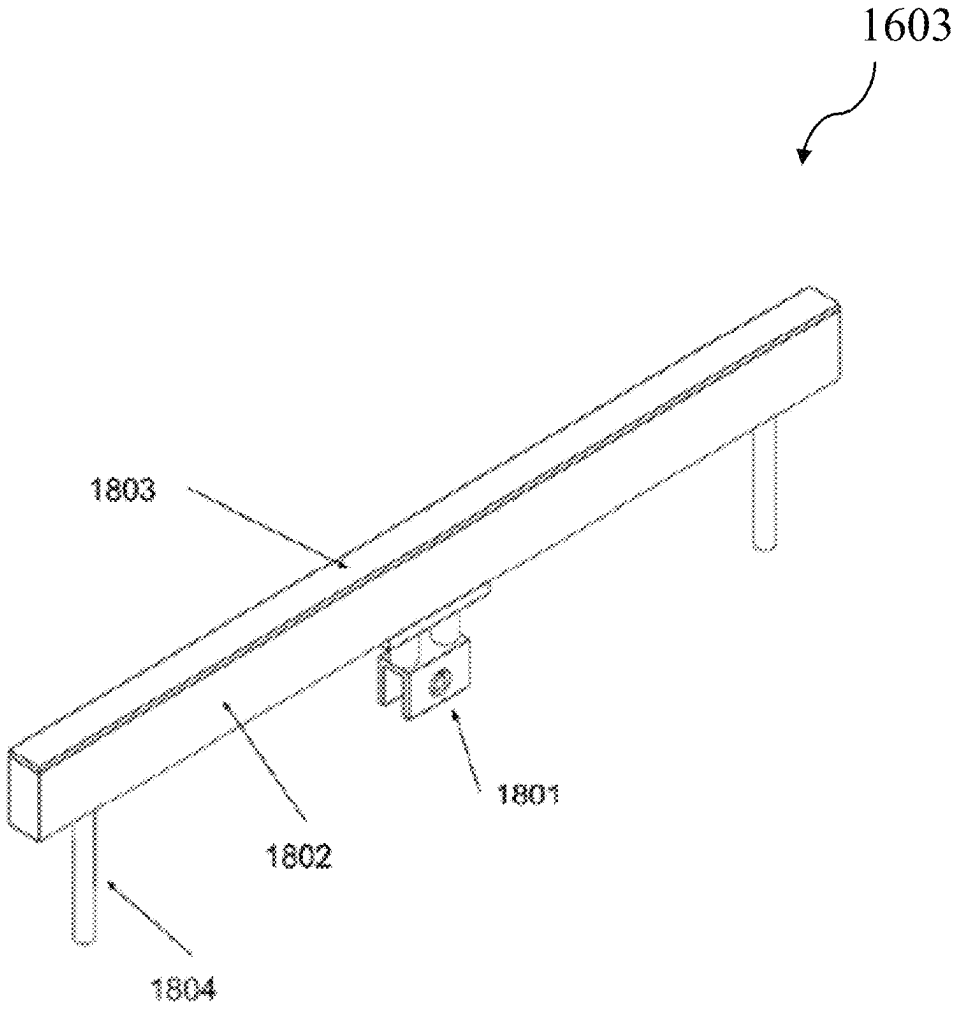


FIG. 9

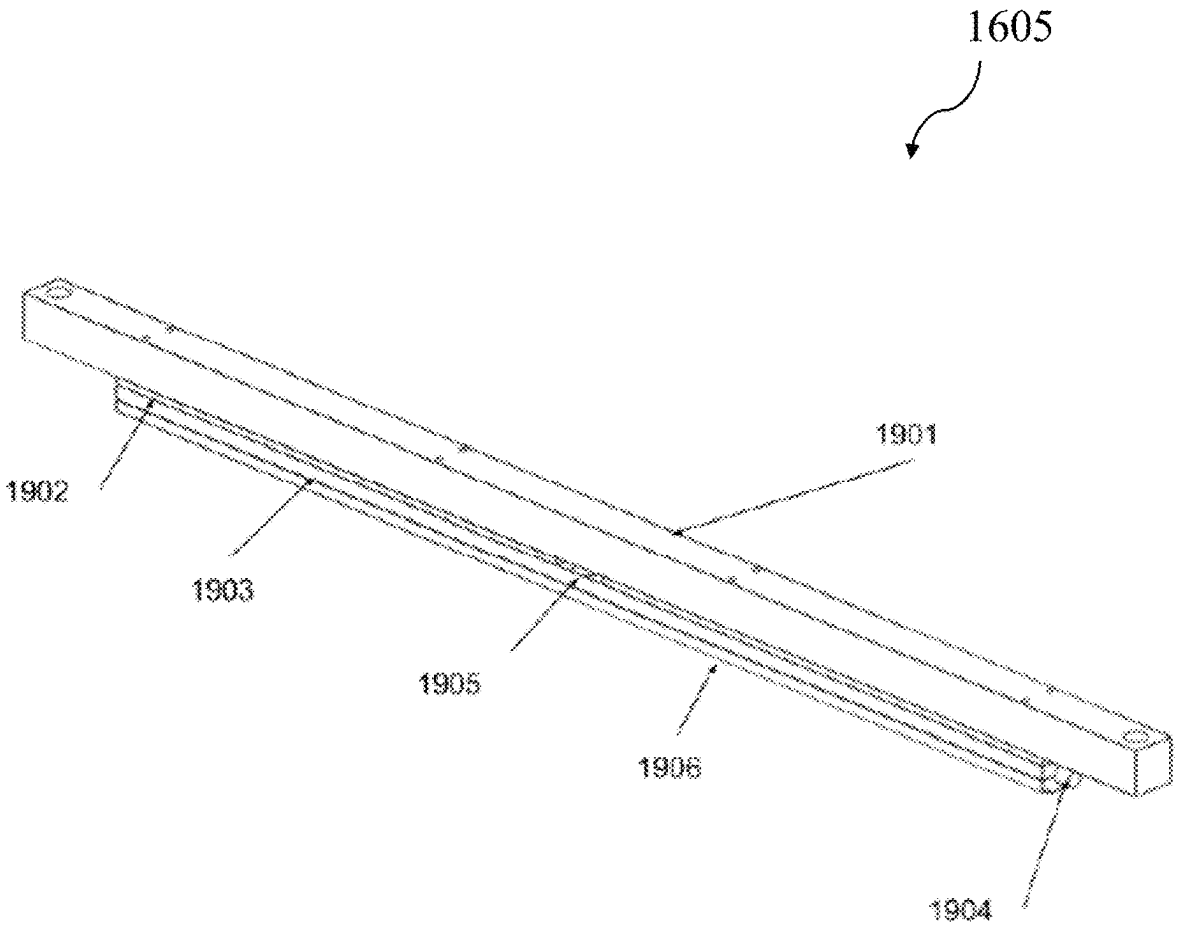


FIG. 10

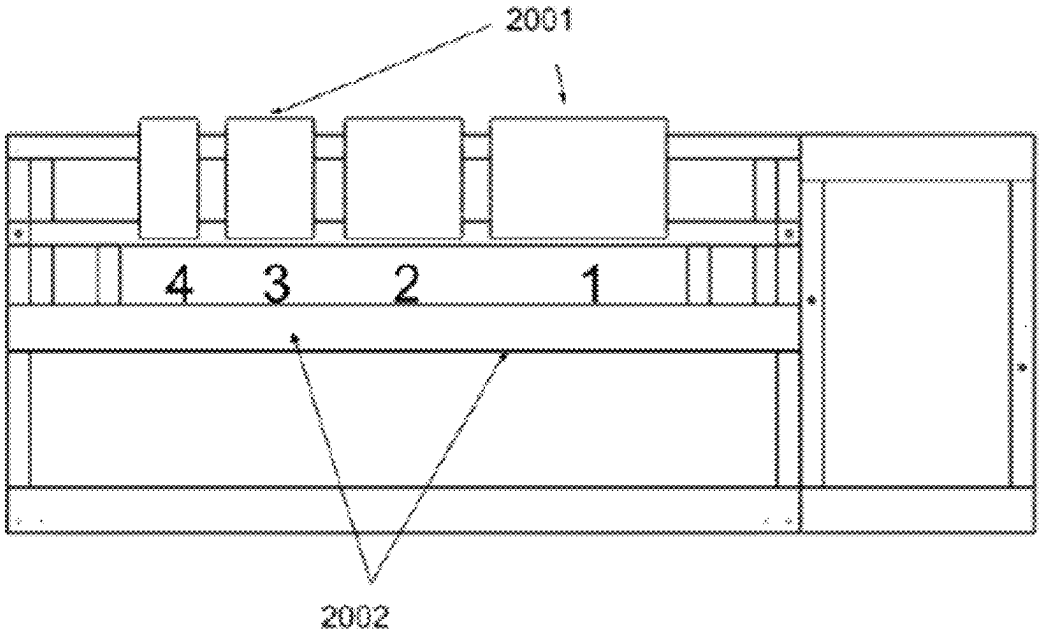


FIG. 11

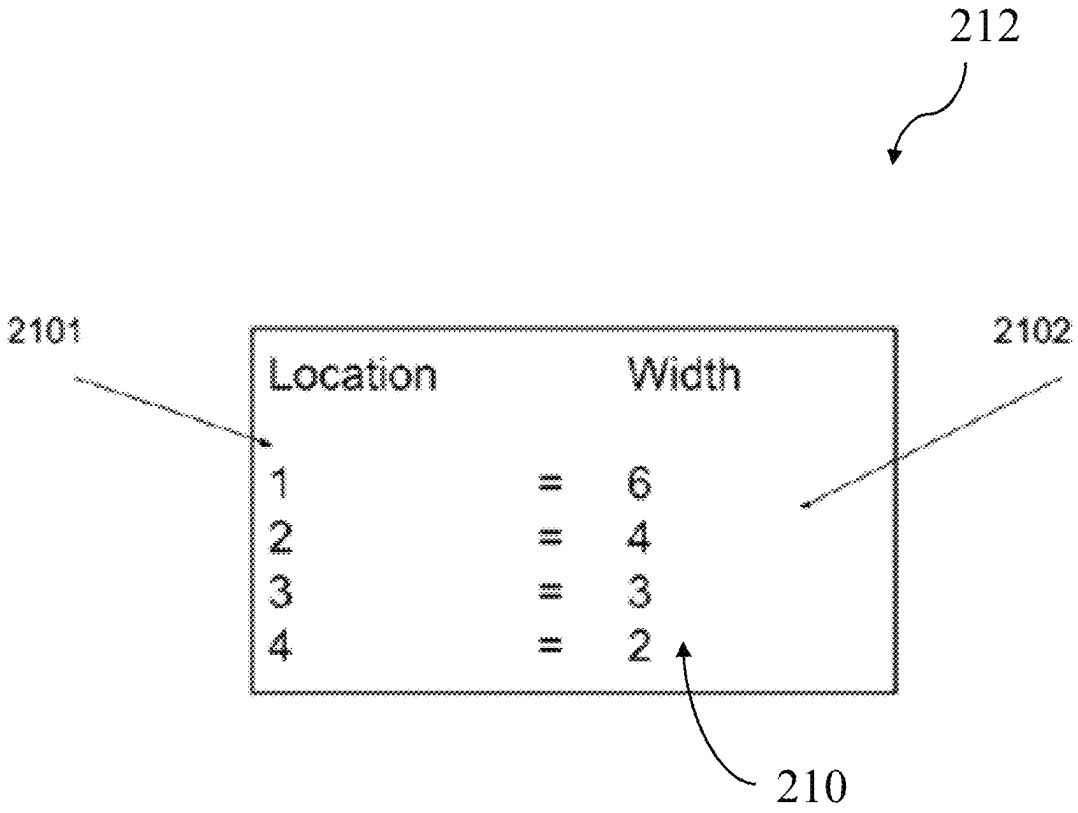


FIG. 12

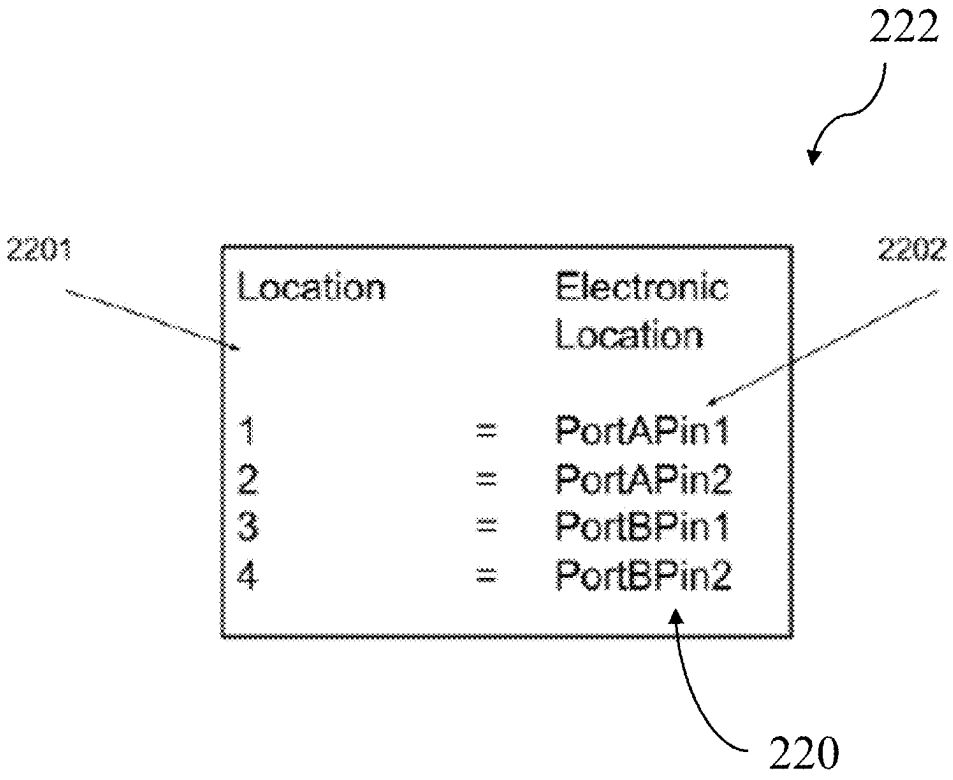

222
2201
2202
Location
Electronic Location
1 = PortAPin1
2 = PortAPin2
3 = PortBPin1
4 = PortBPin2
220

FIG. 13

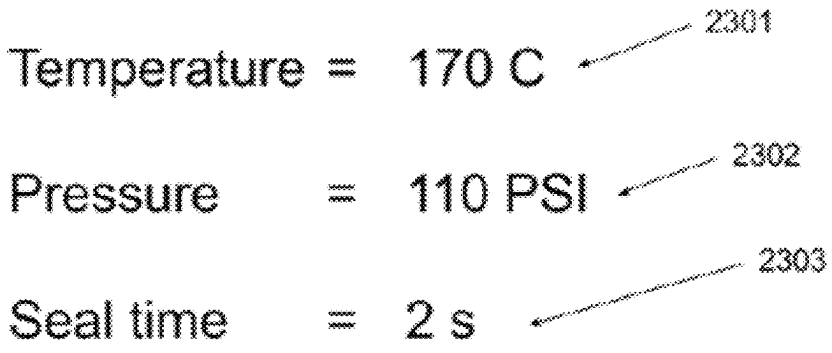

Temperature = 170 C
2301
Pressure = 110 PSI
2302
Seal time = 2 s
2303

FIG. 14

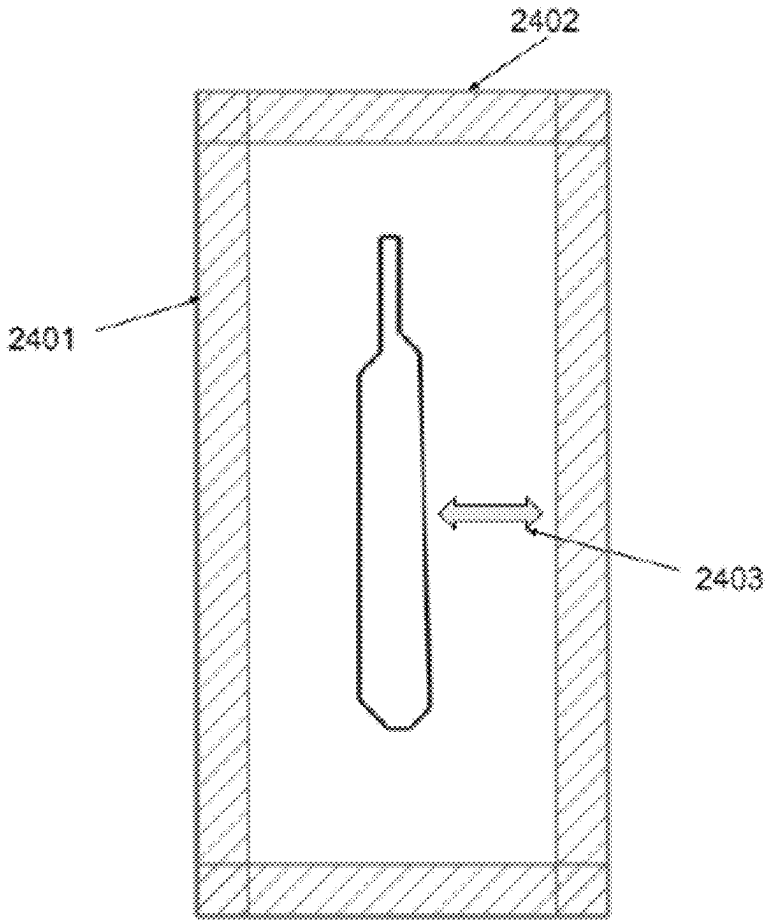


FIG. 15

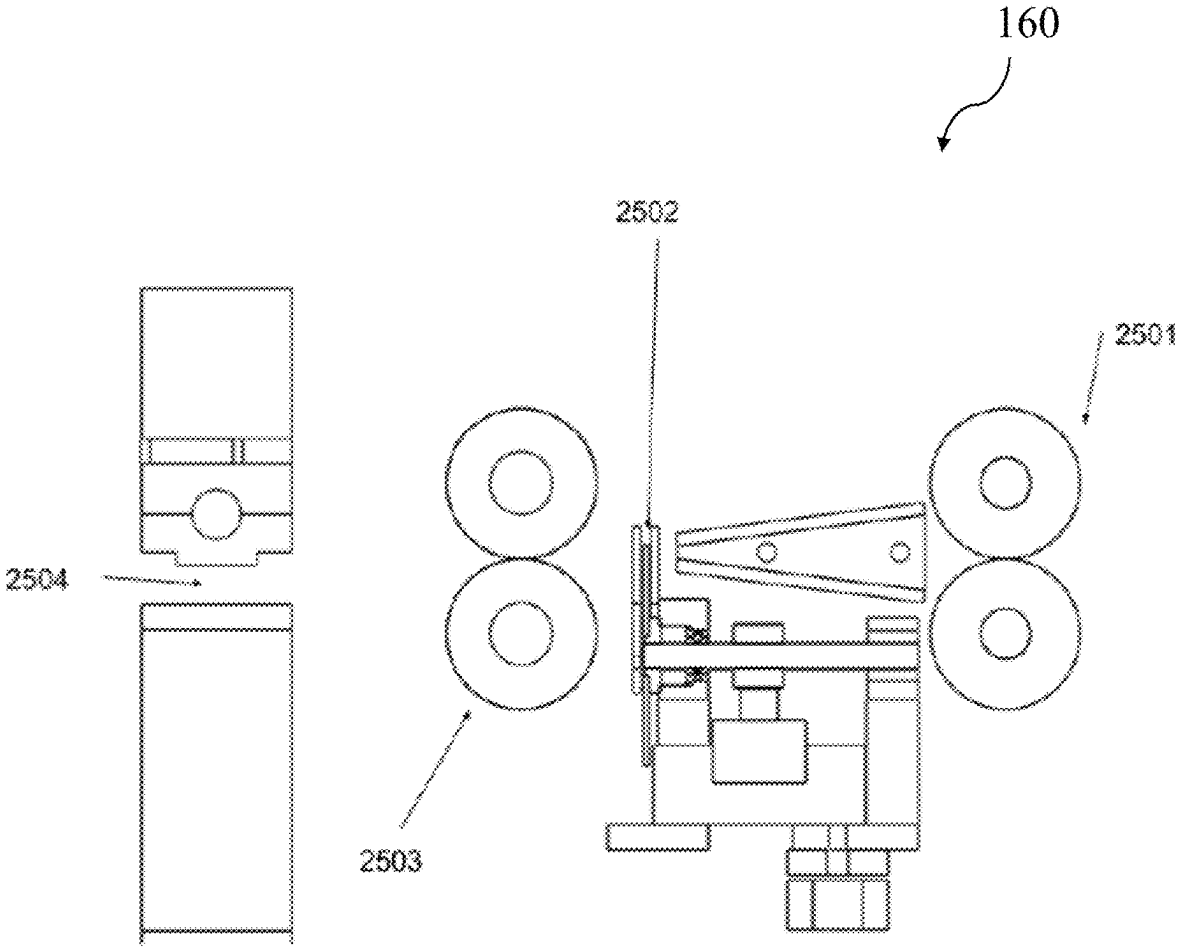


FIG. 16

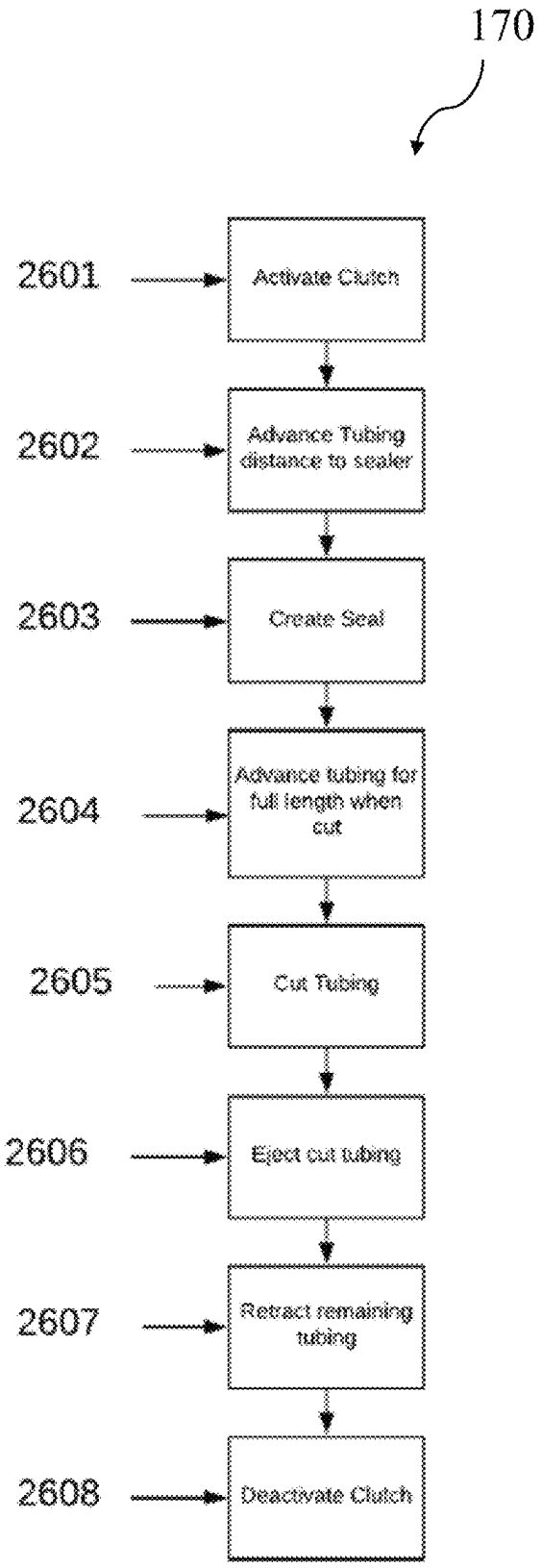

170
2601
Activate Clutch
2602
Advance Tubing distance to sealer
2603
Create Seal
2604
Advance tubing for full length when cut
2605
Cut Tubing
2606
Eject cut tubing
2607
Retract remaining tubing
2608
Deactivate Clutch

FIG. 17

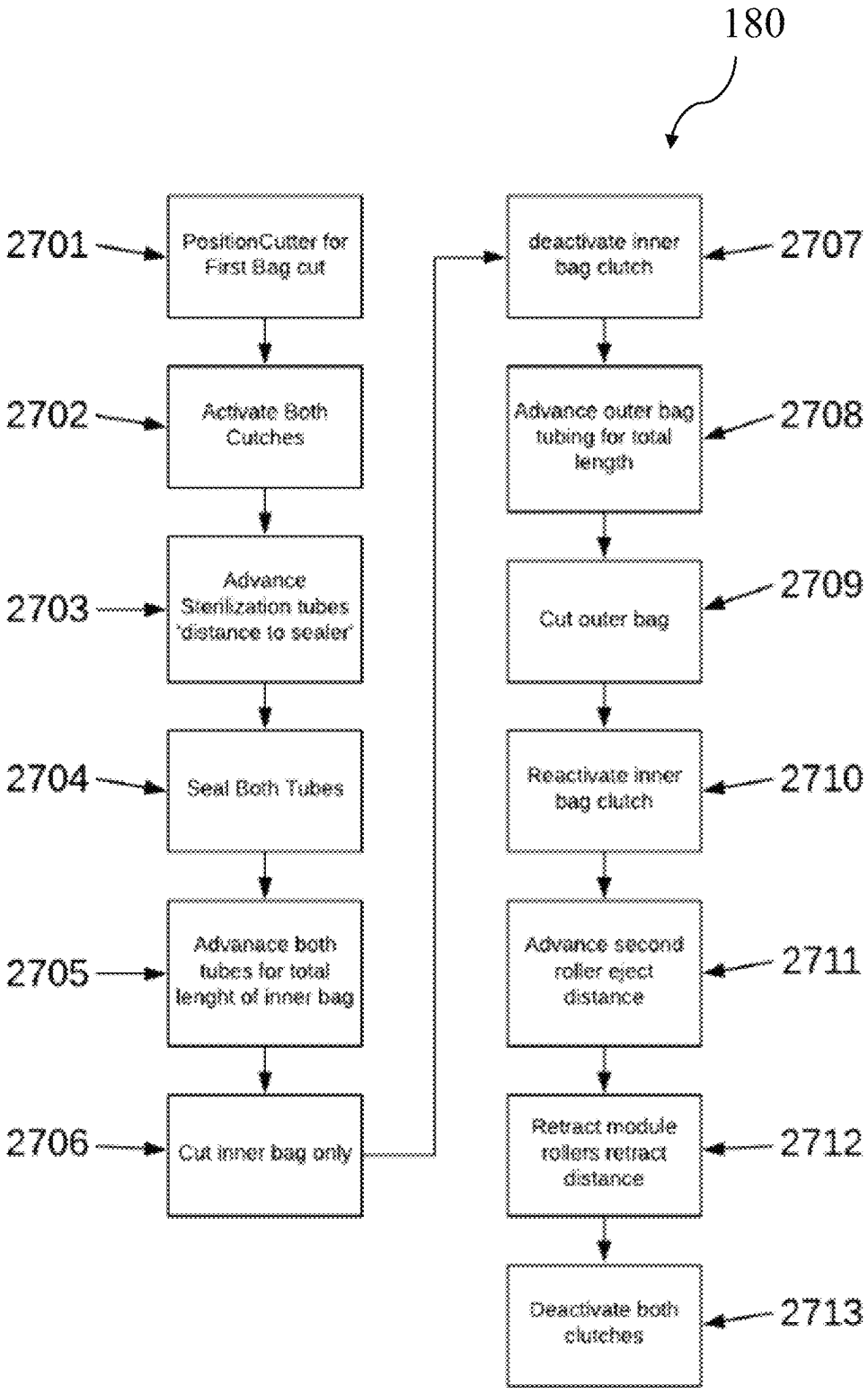

180
2701
PositionCutter for First Bag cut
2702
Activate Both Cutches
2703
Advance Sterilization tubes 'distance to sealer'
2704
Seal Both Tubes
2705
Advanace both tubes for total lenght of inner bag
2706
Cut inner bag only
2707
deactivate inner bag clutch
2708
Advance outer bag tubing for total length
2709
Cut outer bag
2710
Reactivate inner bag clutch
2711
Advance second roller eject distance
2712
Retract module rollers retract distance
2713
Deactivate both clutches

FIG. 18

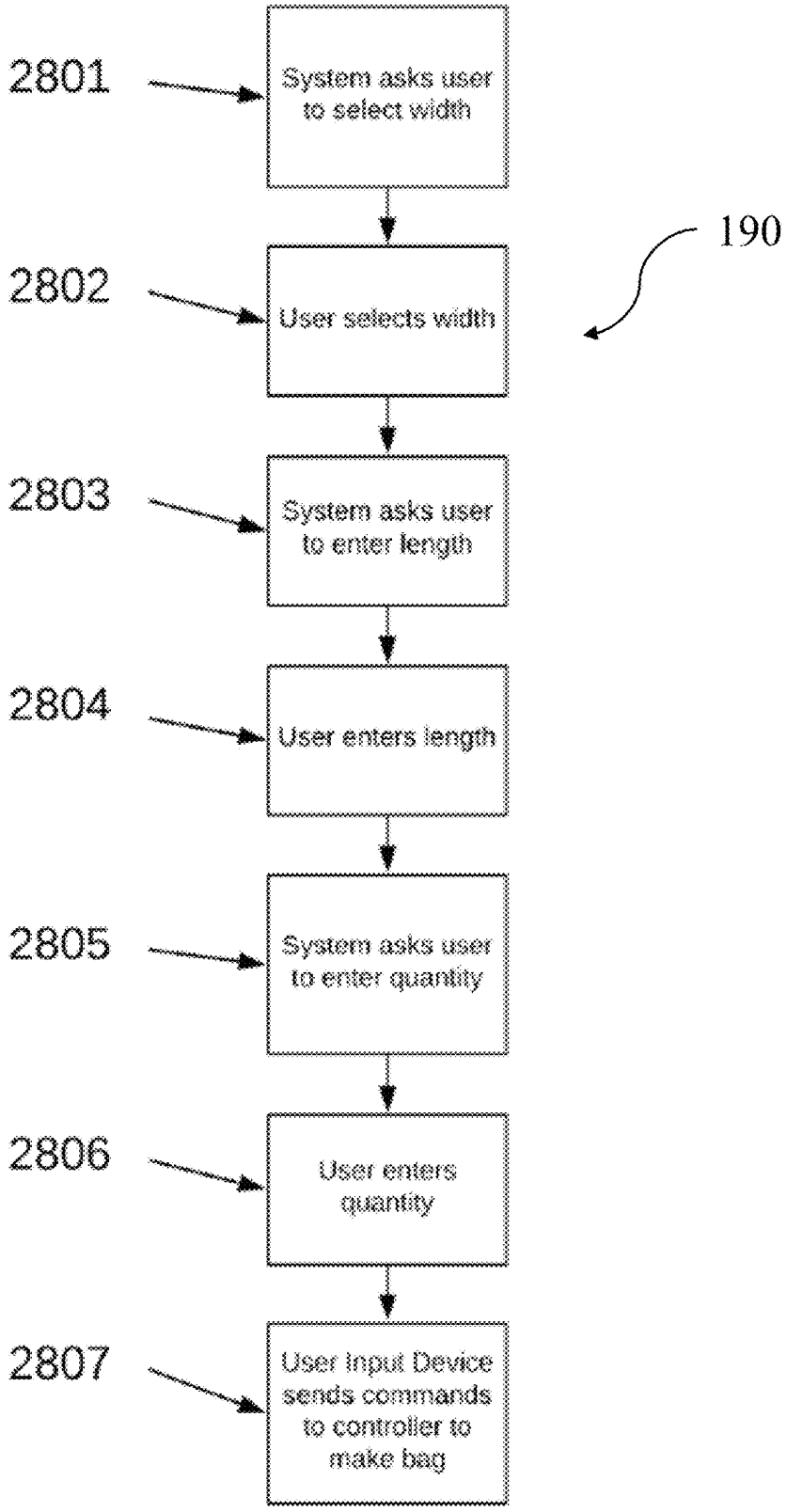

2801
System asks user to select width
190
2802
User selects width
2803
System asks user to enter length
2804
User enters length
2805
System asks user to enter quantity
2806
User enters quantity
2807
User input Device sends commands to controller to make bag

FIG. 19

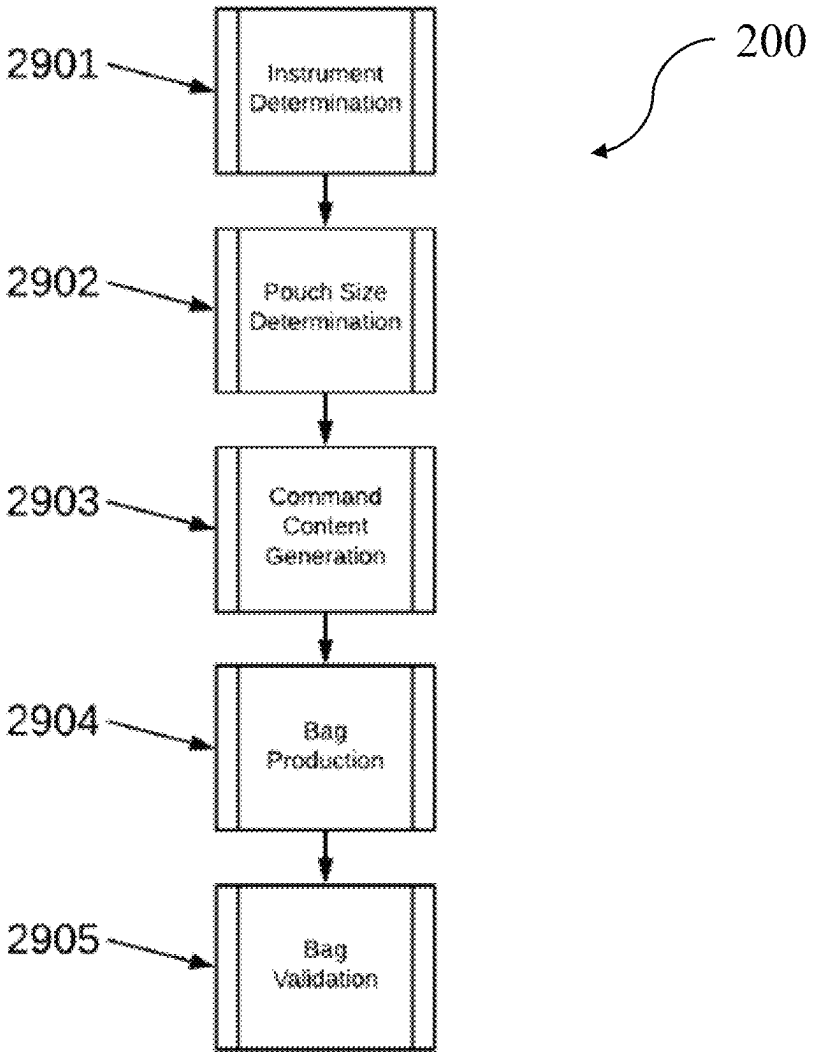

2901
Instrument Determination
200
2902
Pouch Size Determination
2903
Command Content Generation
2904
Bag Production
2905
Bag Validation

FIG. 20

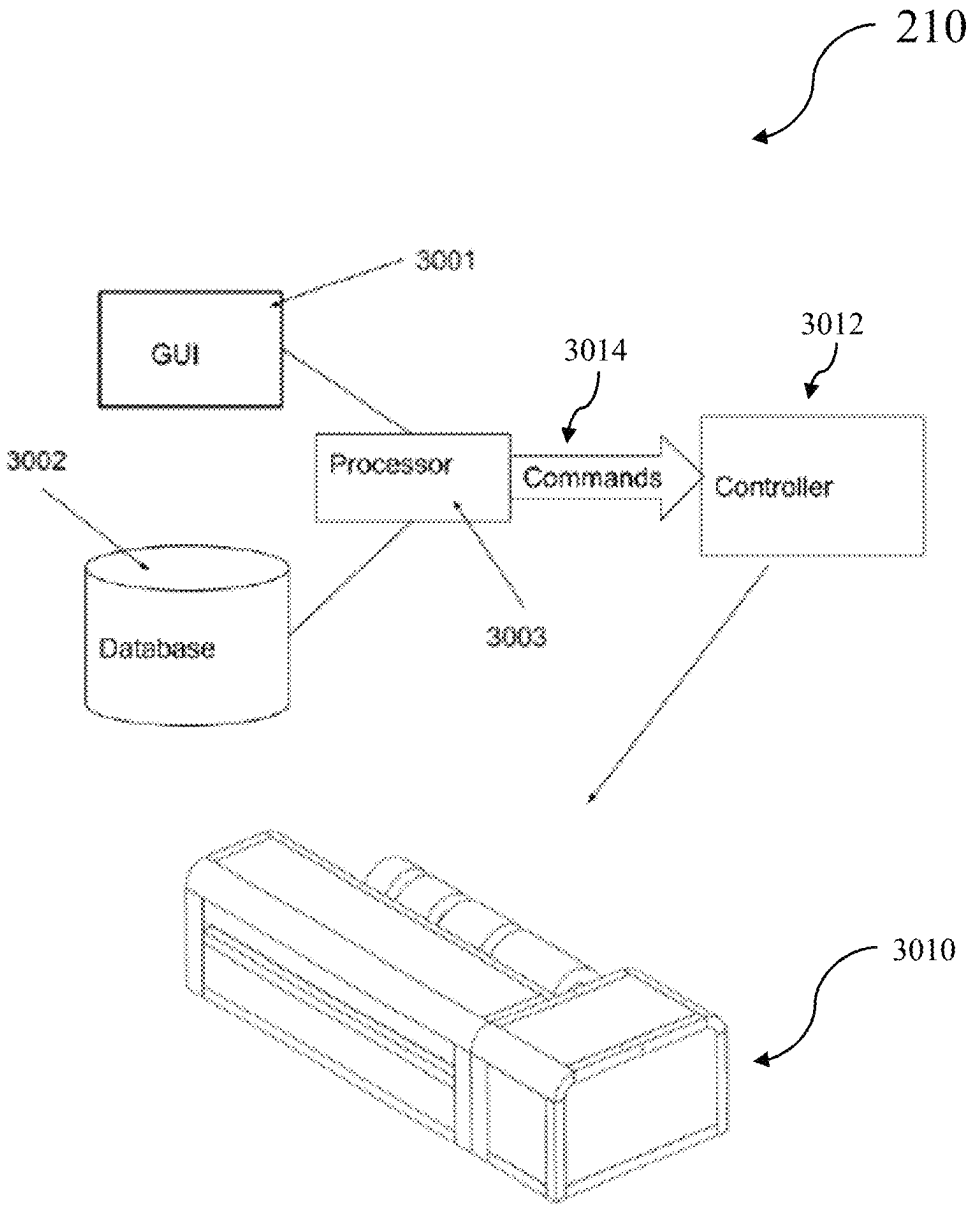

210
3001
GUI
3014
3012
3002
Processor
Commands
Controller
Database
3003
3010

FIG. 21

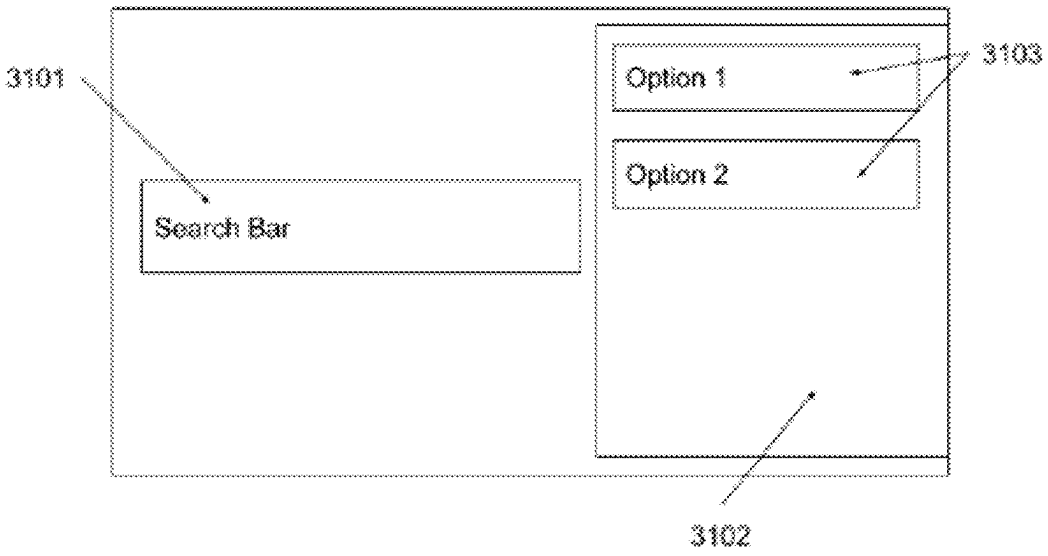


FIG. 22

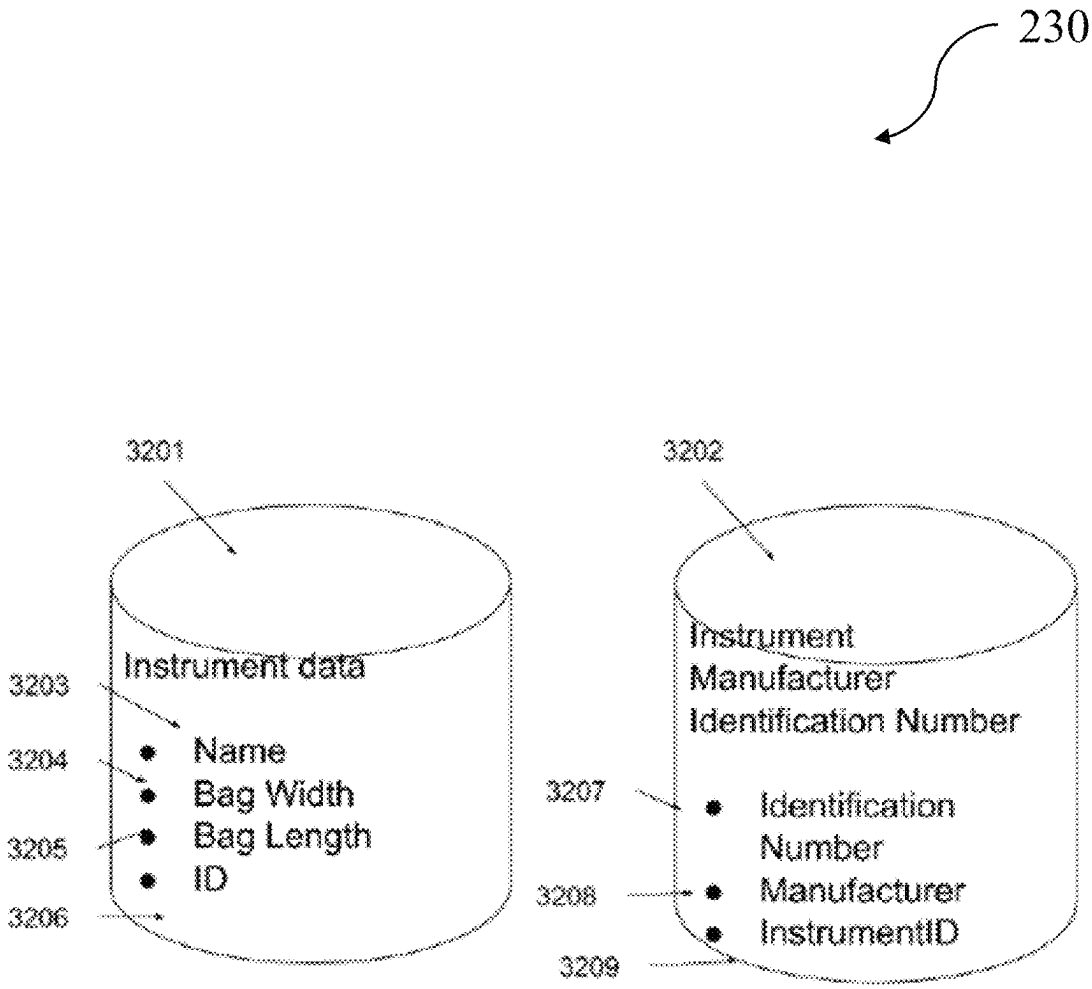

230
3201
3202
Instrument data
3203
Name
3204
Bag Width
Bag Length
3205
ID
3206
Instrument
Manufacturer
Identification Number
3207
Identification
Number
3208
Manufacturer
InstrumentID
3209

FIG. 23

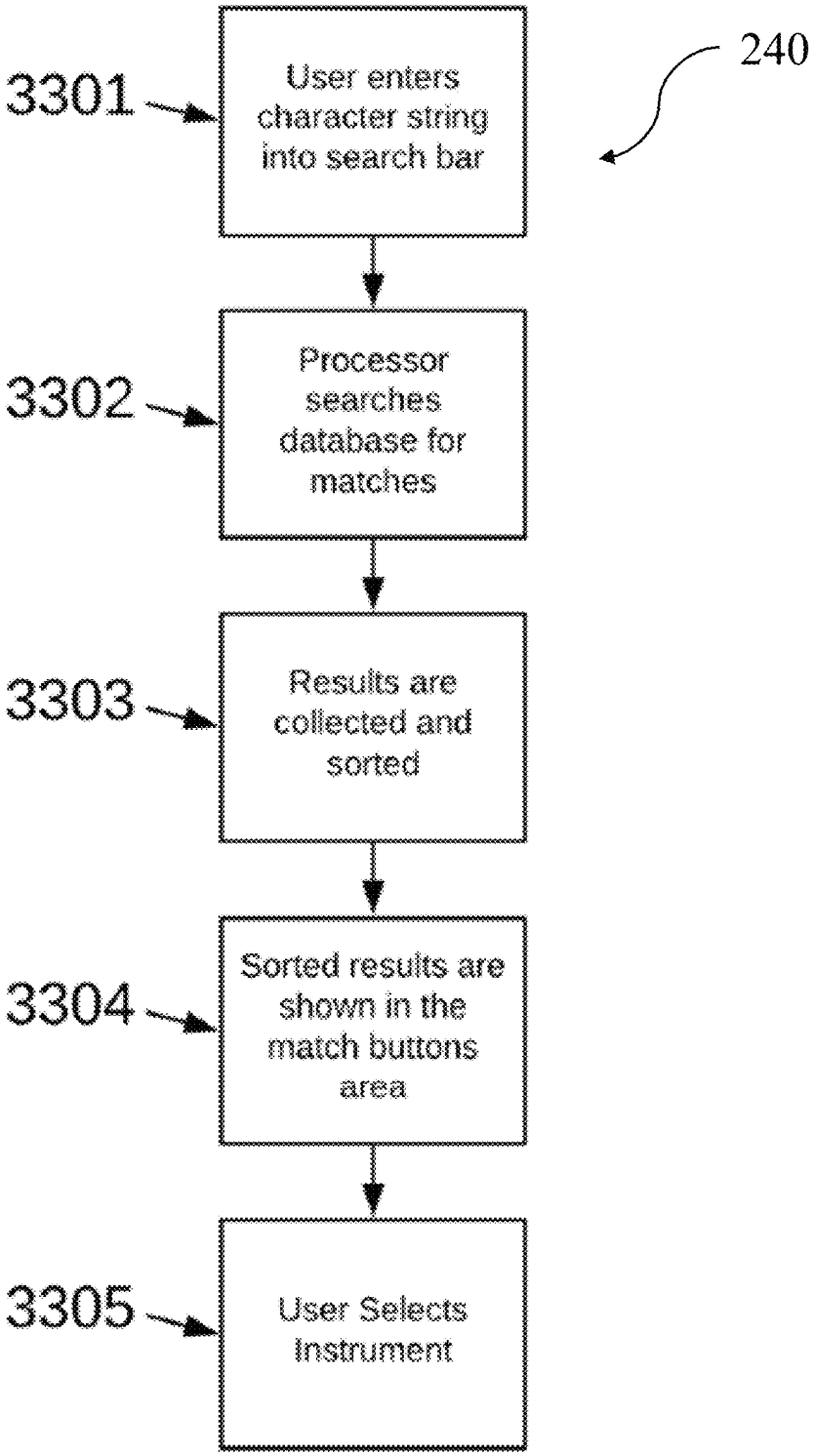

240
3301
User enters character string into search bar
3302
Processor searches database for matches
3303
Results are collected and sorted
3304
Sorted results are shown in the match buttons area
3305
User Selects Instrument

FIG. 24

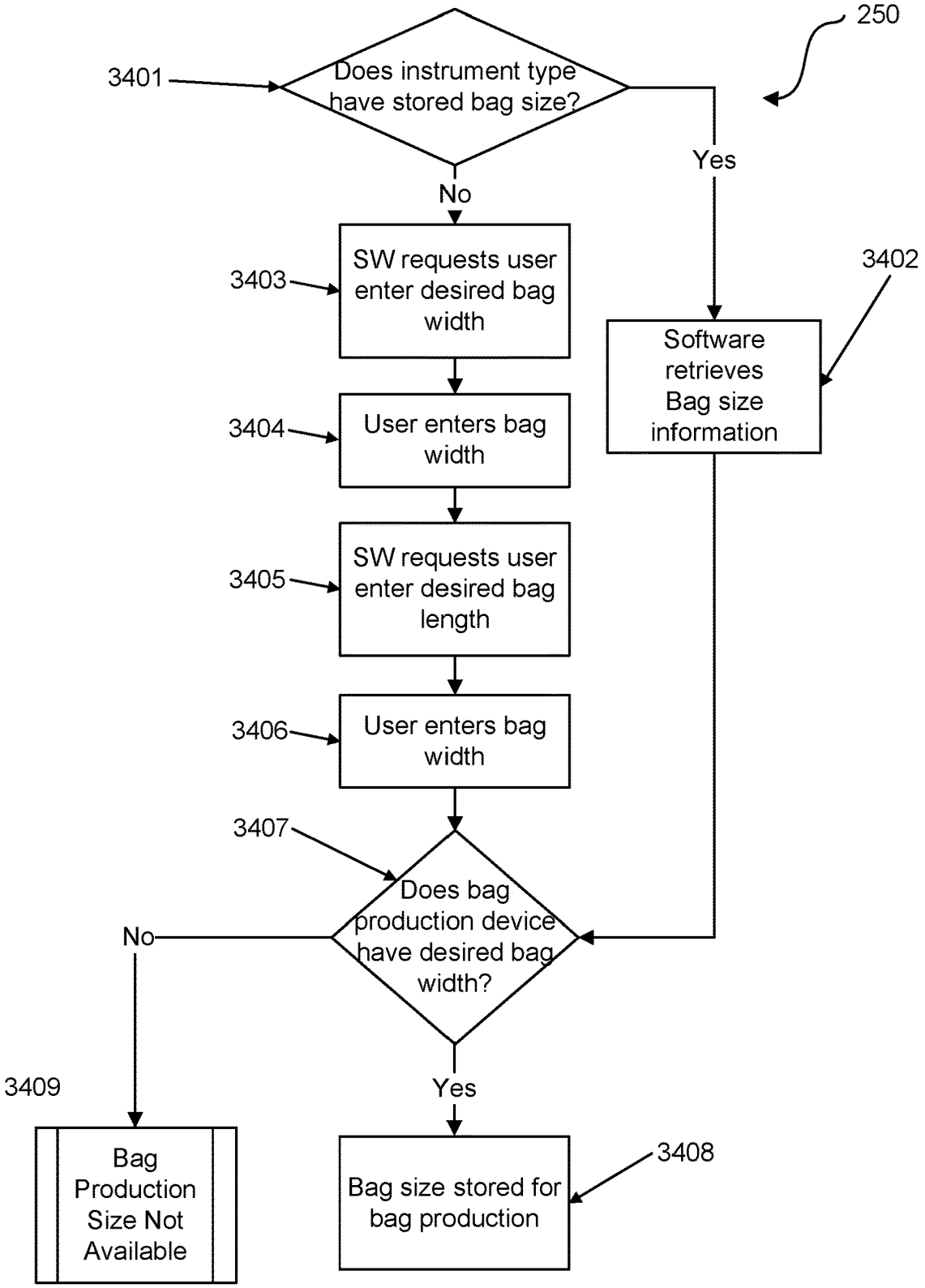

250
3401
Does instrument type have stored bag size?
Yes
No
3403
SW requests user enter desired bag width
3402
Software retrieves Bag size information
3404
User enters bag width
3405
SW requests user enter desired bag length
3406
User enters bag width
3407
Does bag production device have desired bag width?
No
Yes
3409
Bag Production Size Not Available
Bag size stored for bag production
3408

FIG. 25

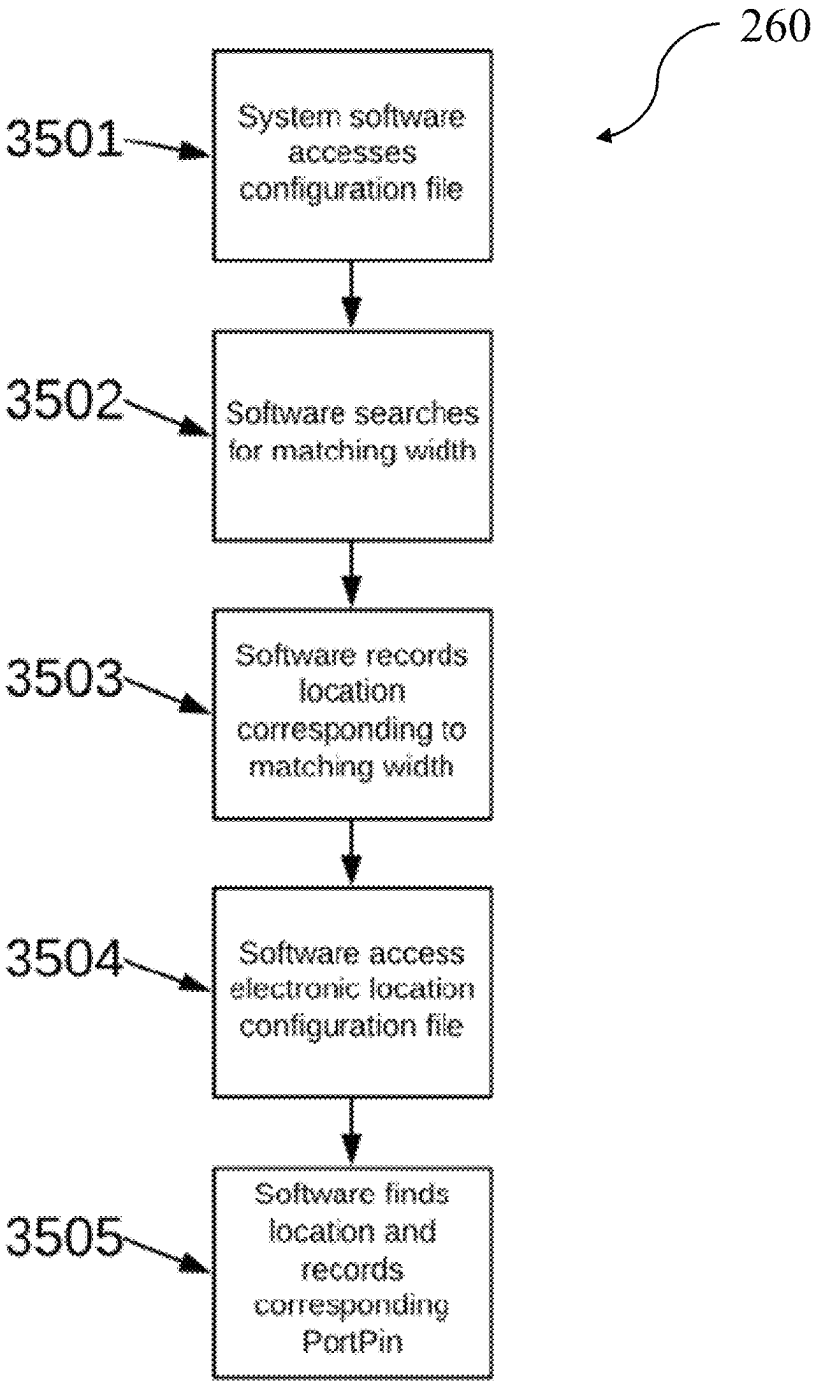

260
3501
System software accesses configuration file
3502
Software searches for matching width
3503
Software records location corresponding to matching width
3504
Software access electronic location configuration file
3505
Software finds location and records corresponding PortPin

FIG. 26

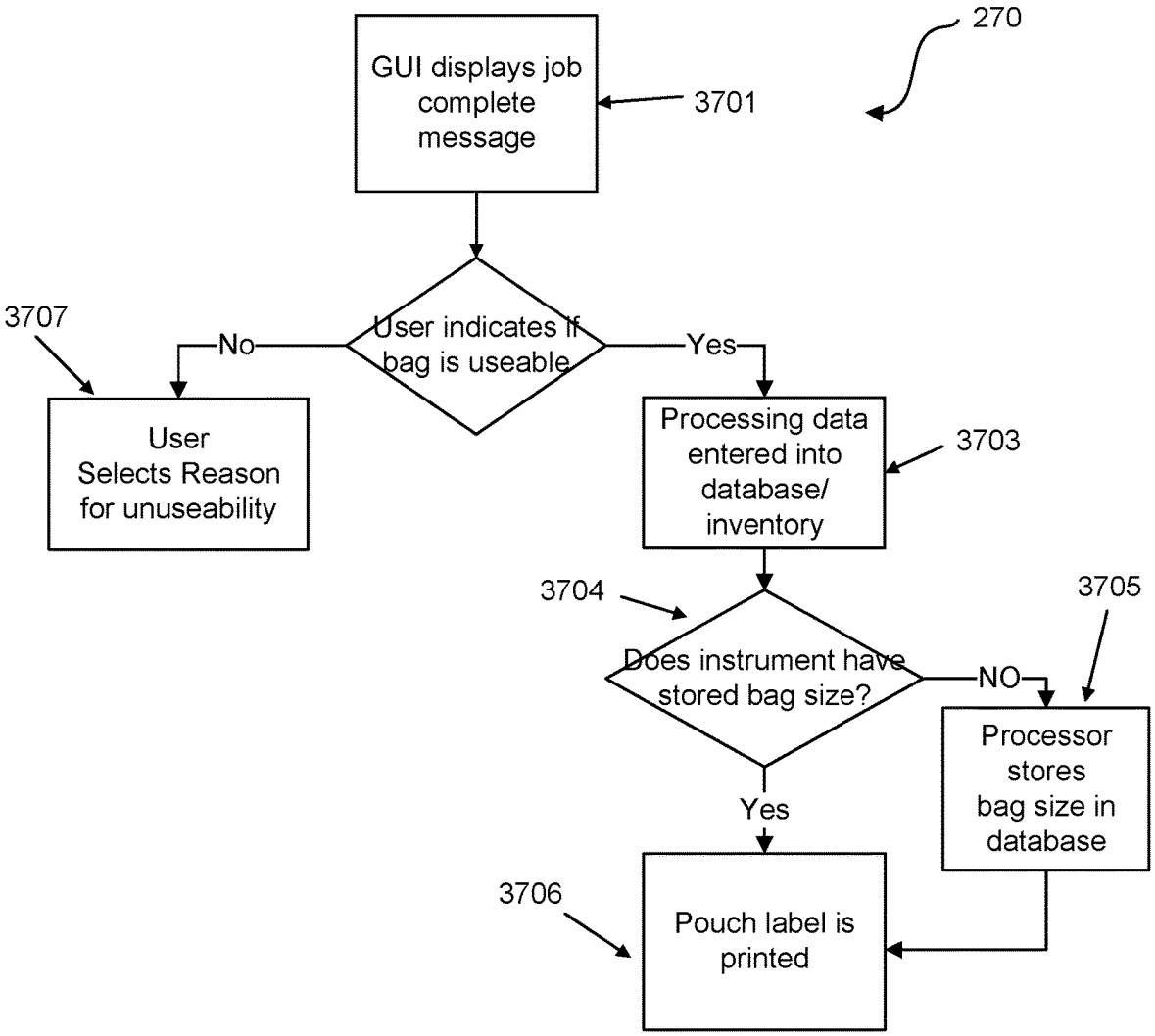

270
GUI displays job complete message
3701
User indicates if bag is useable
3707
No
Yes
User Selects Reason for unuseability
Processing data entered into database/ inventory
3703
3704
Does instrument have stored bag size?
3705
NO
Processor stores bag size in database
Yes
3706
Pouch label is printed

FIG. 27

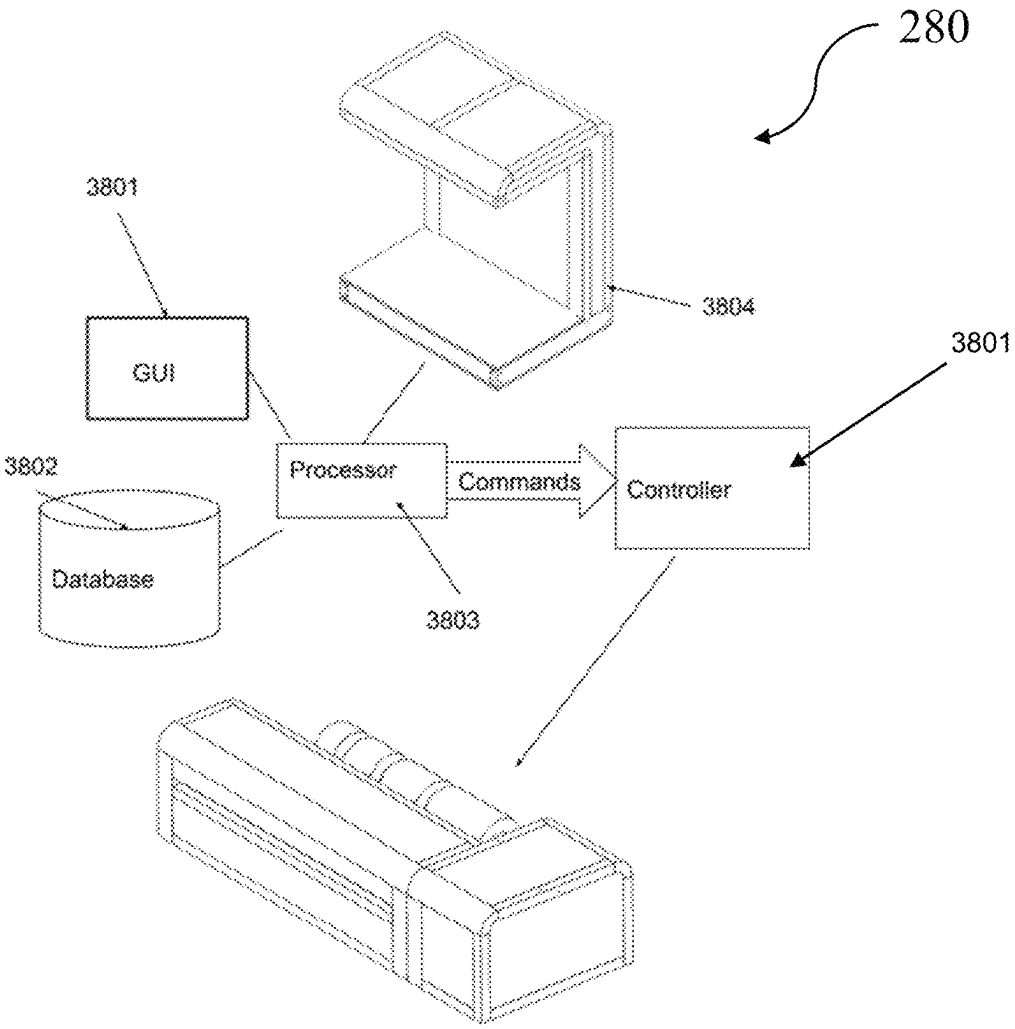

280
3801
GUI
3804
3801
3802
Processor
Commands
Controller
Database
3803

FIG. 28

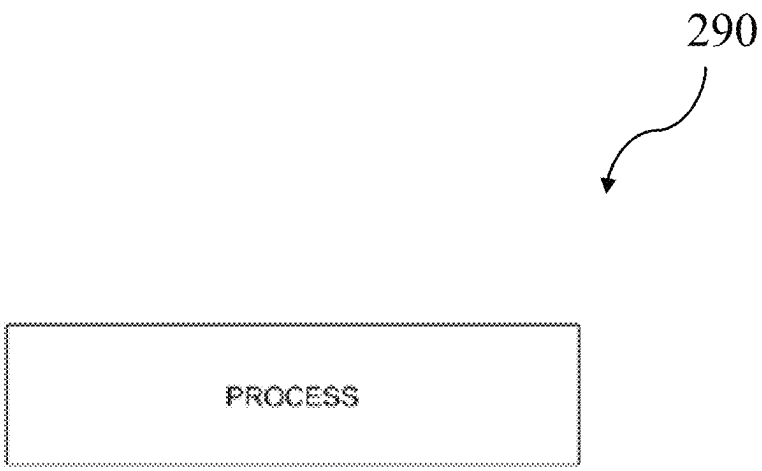


FIG. 29

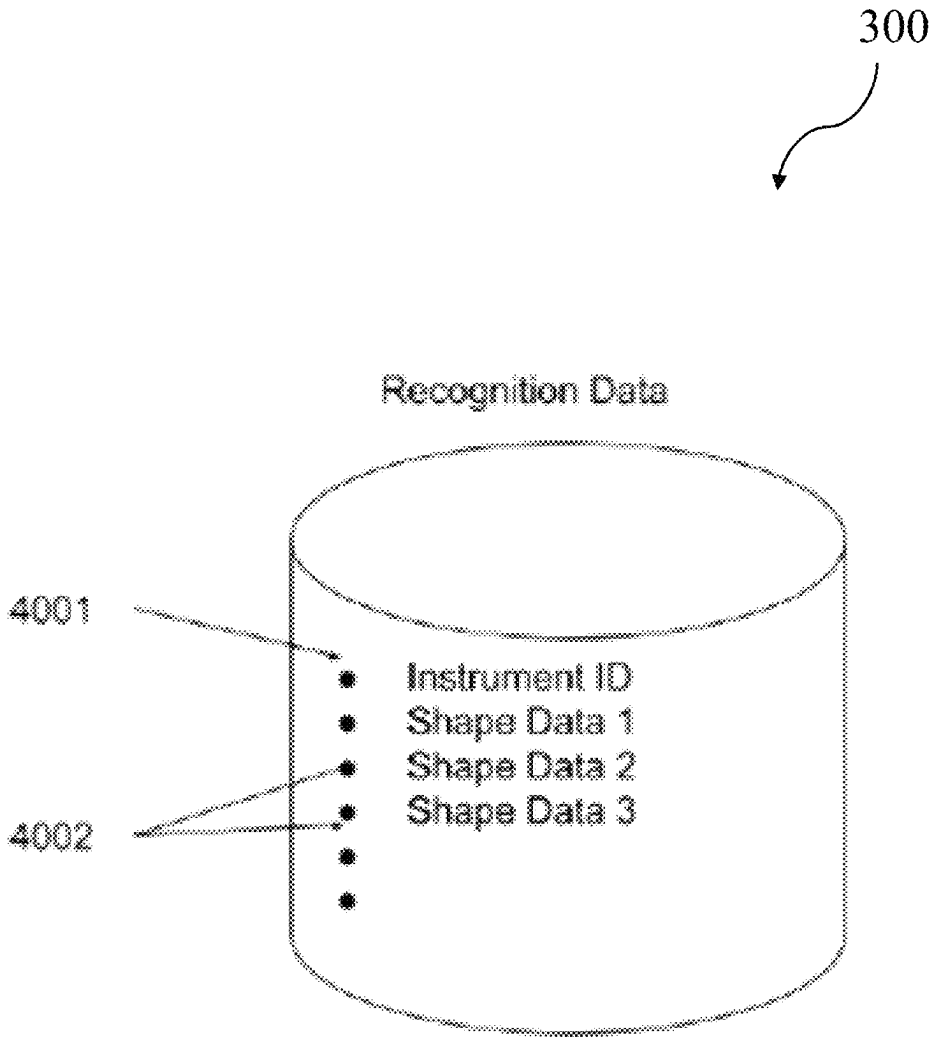

300
Recognition Data
4001
4002
Instrument ID
Shape Data 1
Shape Data 2
Shape Data 3

FIG. 30

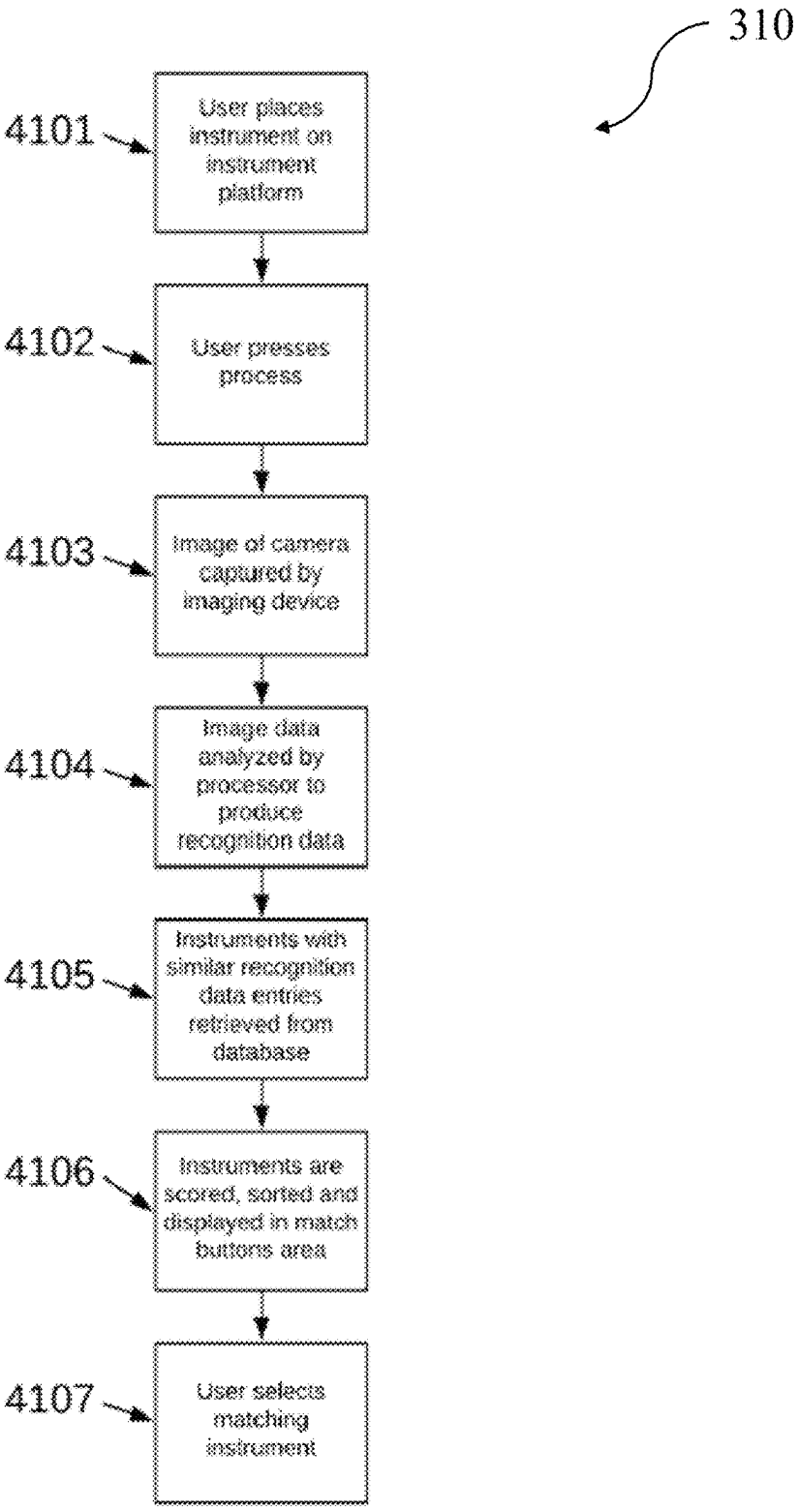

310
4101
User places instrument on instrument platform
4102
User presses process
4103
Image of camera captured by imaging device
4104
Image data analyzed by processor to produce recognition data
4105
Instruments with similar recognition data entries retrieved from database
4106
Instruments are scored, sorted and displayed in match buttons area
4107
User selects matching instrument

FIG. 31

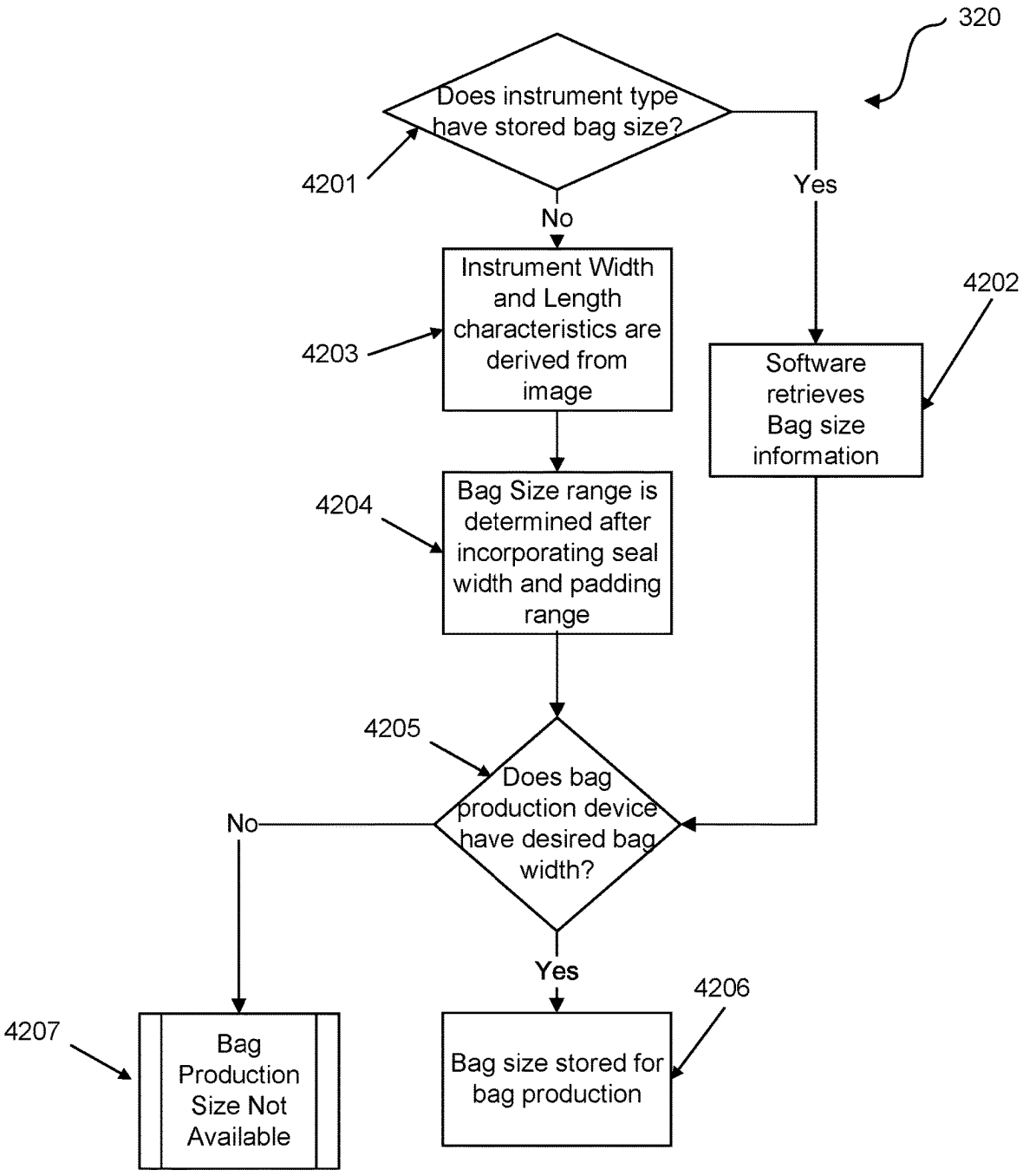

320
Does instrument type have stored bag size?
4201
Yes
No
Instrument Width and Length characteristics are derived from image
4203
4202
Software retrieves Bag size information
Bag Size range is determined after incorporating seal width and padding range
4204
4205
Does bag production device have desired bag width?
No
Yes
4206
4207
Bag Production Size Not Available
Bag size stored for bag production

FIG. 32

FIG. 33

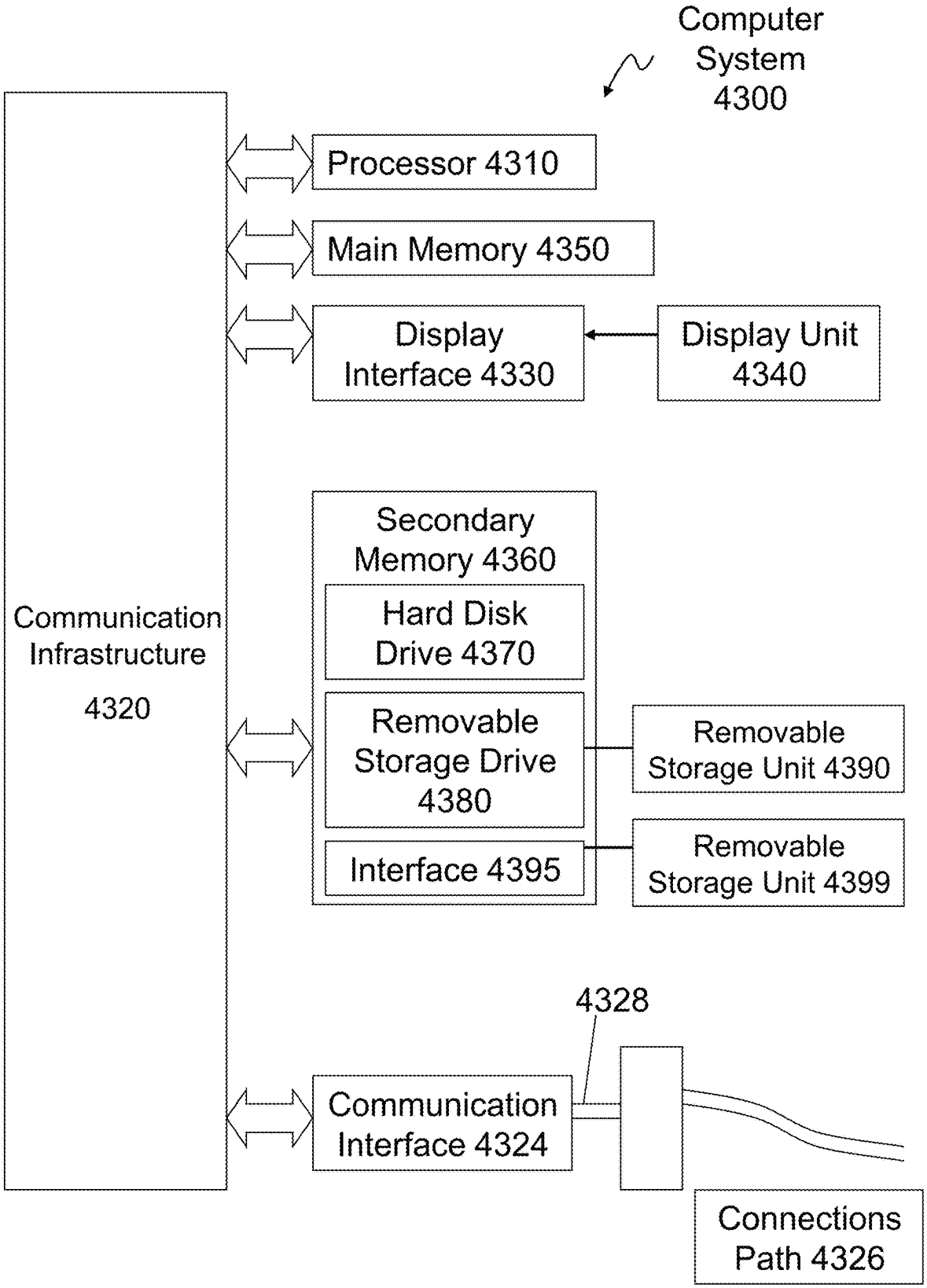
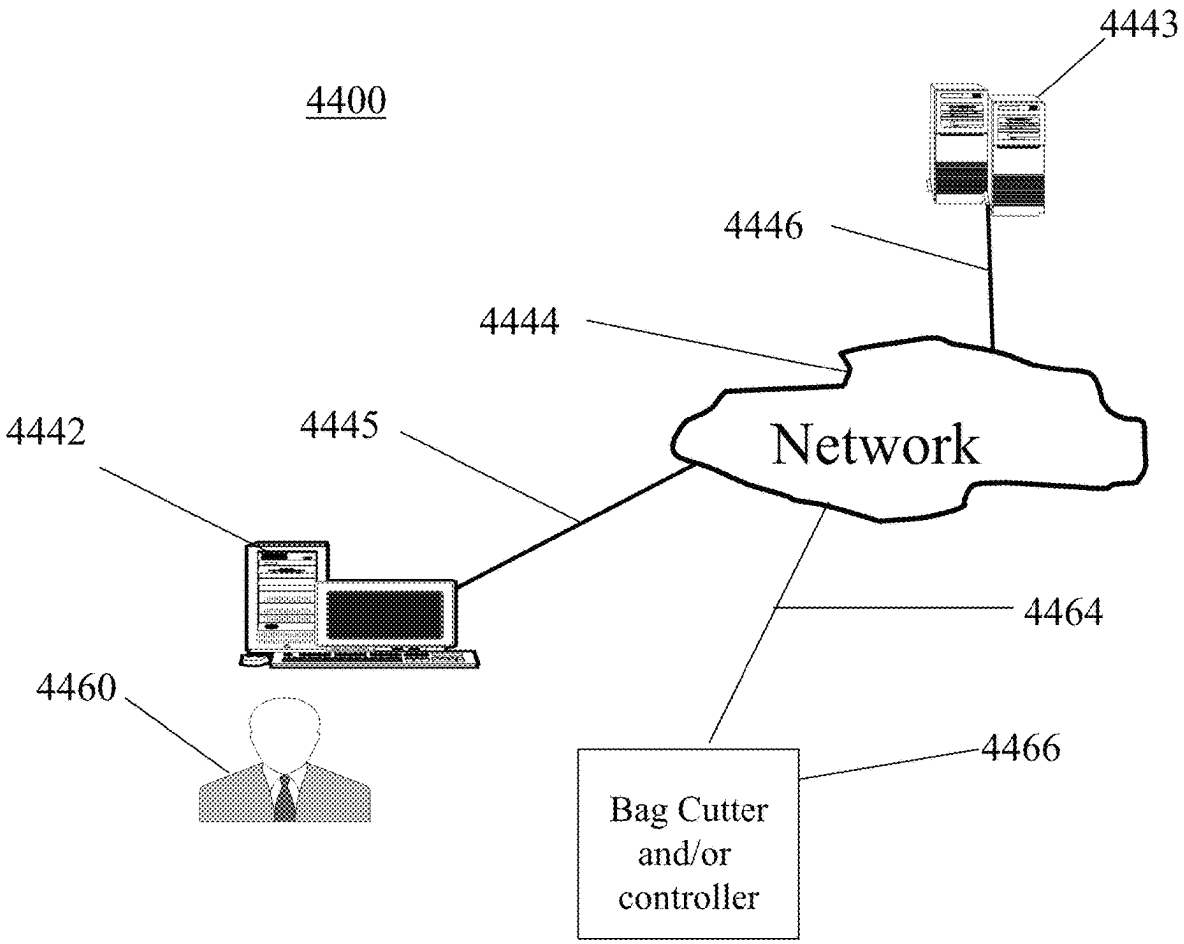

Computer System 4300
Processor 4310
Main Memory 4350
Display Interface 4330
Display Unit 4340
Secondary Memory 4360
Hard Disk Drive 4370
Removable Storage Drive 4380
Interface 4395
Removable Storage Unit 4390
Removable Storage Unit 4399
Communication Infrastructure 4320
4328
Communication Interface 4324
Connections Path 4326

FIG. 34


4400
4443
4446
4444
Network
4442
4445
4464
4460
4466
Bag Cutter and/or controller

SYSTEMS AND METHODS FOR PACKAGING INSTRUMENTS OR OTHER ITEMS WITH BAG MAKING FEATURES

CROSS-REFERENCE TO RELATED APPLICATIONS

The current application claims priority to, and the benefit of, U.S. Provisional Application No. 63/008,277 filed on Apr. 10, 2020, entitled "Systems and Methods for Packaging Instruments or Other Items with Bag Making Features," the contents of which are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

Aspects of the present disclosure relate to bag, pouch, or peel pouch making devices for the production of bags, pouches, and/or peel pouches for sterilization and packaging a variety of different devices, such as medical instruments, that may require bags, pouches, and/or peel pouches of varying parameters, including dimensions, material, etc.

BACKGROUND

In the production of devices required to meet strict sterilization requirements, such as medical instruments for use in hospitals, the devices must be packaged and sterilized such that the sterilization is not compromised during the final stages of production, shipping, or storage before their implementation. Thus, as part of the sterilization process, these devices are often packaged in bags, pouches, and/or peel pouches.

SUMMARY

Consequent of the deficiencies described above, as well as others, there remains an unmet need for a bagmaker for automating bags, pouches, and/or peal pouches for packaging and sterilizing a variety of different devices, wherein the devices include a variety of different parameters, such as dimensions or materials.

According to various aspects, the present disclosure describes a bagmaker interoperable, for example, with an instrument processor, wherein the bagmaker may be configured to produce bags, pouches and/or peal pouches for packaging instruments, such as medical instruments for sterilization. The bagmaker may include a controller and a bag production device, wherein the controller and the bag production device may interoperate such that a selected quantity of tubing may be fed to the bag production device, cut to a specified length, and then heat sealed by the bag production device via a plurality of commands issued by the controller. In order to cut and heat seal the tubing, the bag production device may include a bag cutter and a heat sealing device. The bagmaker may further include at least one roller, wherein each roller may be interoperable with a motor, such that the one roller may supply the tubing to the bagmaker. The tubing may comprise the material from which the bags, pouches, and/or peel pouches are made.

Further, aspects of the present disclosure describe a variety of example methods of use of the bagmaker. In one example, the method may include identifying tubing of the correct width for producing the appropriately dimensioned bag. Following, the tubing may be advanced a length corresponding to the desired length of the bag, such that the tubing may align at the correct point with a heat sealer component of the bagmaker. This may allow for the bagmaker to form a bag of the desired length. Then the method may further include sealing a first end of the tubing, wherein the seal may be formed via a heat sealer component of the bagmaker. Following, the method of the present disclosure may include advancing the tubing an additional length, wherein the additional length may also correspond to a desired length of the bag. The cut in combination with the seal may produce a bag, pouch, and/or peel pouch for an instrument, such as a medical device instrument. The method may next include ejecting the bag, pouch, and/or peel pouch from the bagmaker and retracting remaining uncut tubing, wherein the retraction and ejection may occur contemporaneously or interchangeably in order. In another example, the bag width and length may be determined based on the size and packaging of the instrument to be bagged. An item may then, for example, be received within a second, open end of the bag, pouch, and/or peel pouch, and the second end may then be sealed, such as by re-insertion of the second end within the heat sealer component.

Additional advantages and novel features of these aspects will be set forth in part in the description that follows, and in part will become more apparent to those skilled in the art upon examination of the following or upon learning by practice of the disclosure.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a perspective view of an example bagmaker, according to various aspects of the present disclosure.

FIG. **2** is a perspective view of an example bagmaker with a removed cover, according to various aspects of the present disclosure.

FIG. **3**A is a front perspective view of an example module roller, according to various aspects of the present disclosure.

FIG. **3**B is a rear perspective view of an example module roller, according to various aspects of the present disclosure.

FIG. **4** is a perspective view of an example bag cutter, according to various aspects of the present disclosure.

FIG. **5** is a perspective view of an example circular blade carriage assembly, according to various aspects of the present disclosure.

FIG. **6** is a perspective view of an example second roller, according to various aspects of the present disclosure.

FIG. **7** is a perspective view of an example heat sealer, according to various aspects of the present disclosure.

FIG. **8** is a perspective view of an example drive, according to various aspects of the present disclosure.

FIG. **9** is a perspective view of an example compression bar according to various aspects of the present disclosure.

FIG. **10** is a perspective view of an example hot bar, according to various aspects of the present disclosure.

FIG. **11** is a perspective view of an example plurality of tubes for use in accordance with various aspects of the present disclosure.

FIG. **12** shows an example port pin corresponding to a particular location maintained as computer readable data within a configuration file, according to various aspects of the present disclosure.

FIG. **13** shows another example of port pins corresponding to a particular location within a configure file, according to various aspects of the present disclosure.

FIG. **14** is a table including a plurality of example parameters for use in production of bags used for sterilization, according to various aspects of the present disclosure.

FIG. **15** is an example of an instrument that has been placed within and sealed into a tubing according to various aspects of the present disclosure.

FIG. **16** is a cross-sectional view of an example bagmaker, according to various aspects of the present disclosure.

FIG. **17** is a flow chart depicting a method for the production of a single bag implementing an example bagmaker, according to various aspects of the present disclosure.

FIG. **18** shows various elements of a flow chart for an example method of production of a bag by a bagmaker, in accordance with aspects of the present disclosure.

FIG. **19** is a flow chart illustrating a method for producing bags including an input device configured for receipt of input commands, according to various aspects of the present disclosure.

FIG. **20** is a flow chart illustrating a method for automating peel pouch production, according to various aspects of the present disclosure.

FIG. **21** is a flow chart illustrating a method for automating the packaging of items, such as surgical instruments, into bags, peel pouches, or pouches for sterilization, according to various aspects of the present disclosure.

FIG. **22** is an example Graphic User Interface interoperable with an example bagmaker, according to various aspects of the present disclosure.

FIG. **23** is an example data repository configuration, for use in accordance with various aspects of the present disclosure.

FIG. **24** is a flow chart illustrating a method search and selection process, according to various aspects of the present disclosure.

FIG. **25** is a flow chart illustrating a method for determining bag size for a bag produced by an example bagmaker, according to various aspects of the present disclosure.

FIG. **26** is a flow chart illustrating a method for generating the appropriate content for the controller commands with regard to the desired bag size for a bag to be produced by an example bagmaker, according to various aspects of the present disclosure.

FIG. **27** is a flow chart illustrating a method describing an example process of bag validation, according to various aspects of the present disclosure.

FIG. **28** is a flow chart illustrating a method for automating the packaging of items, such as surgical instruments, into bags, peel pouches, or pouches for sterilization, according to various aspects of the present disclosure.

FIG. **29** is a Graphic User Interface including an example process button, according to various aspects of the present disclosure.

FIG. **30** illustrates a data repository including a table for recognition data, for use in accordance with various aspects of the present disclosure.

FIG. **31** is a flow chart illustrating a method for performing an item image recognition process, according to various aspects of the present disclosure.

FIG. **32** is a flow chart illustrating a method for visual identification of an item type and determination of bag size, for use in accordance with various aspects of the present disclosure.

FIG. **33** shows various aspects of an example computer system usable in accordance with aspects of the present disclosure.

FIG. **34** is a block diagram of various example system components, for use in accordance with aspects of the present disclosure.

DETAILED DESCRIPTION

The detailed description set forth below in connection with the appended drawings is intended as a description of various configurations and is not intended to represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be apparent to those skilled in the art that these concepts may be practiced without these specific details.

Throughout the disclosure, the term approximately may be used as a modifier for a geometric relationship among elements or for the shape of an element or component. While the term approximately is not limited to a specific variation and may cover any variation that is understood by one of ordinary skill in the art to be an acceptable variation, some examples are provided as follows. In one example, the terms approximately may include a variation of less than 10% of the dimension of the object or component. In another example, the term approximately may include a variation of less than 5% of the object or component. If the term approximately is used to define the angular relationship of one element to another element, one non-limiting example of the term substantially or approximately may include a variation of 5 degrees or less. These examples are not intended to be limiting and may be increased or decreased based on the understanding of acceptable limits to one of skill in the relevant art.

For purposes of the disclosure, directional terms are expressed generally with relation to a standard frame of reference when the system and apparatus described herein are installed an in an in-use orientation. In order to provide context to the current disclosure, a broad overview of the discovered deficiencies of various systems and an example implementation of the current disclosure and the advantages provided by the disclosure are described below. Further details of example implementations of the current disclosure are described in detail with reference to the figures below.

In implementations that require the re-sterilization of recently cleaned items or the sterilization of just produced items, the process of sterilization or re-sterilization may include placing an item, such as a medical instrument, inside of a semi-permeable bag, pouch, or peel pouch, wherein the bag, pouch, or peel pouch (hereinafter also interchangeably referred to herein as "packaging"), and the enclosed item may be may sterilized via steam or another suitable chemical based or other sterilization method. In one example implementation, the bag, pouch, or peel pouch may include of two different sides, one side comprising a semi-permeable (e.g., paper) material and the other side comprising a semi-permeable plastic material. In some implementations of the production of this packaging for devices to be sterilized, in order to preserve the sterilization required through the later stages of production, shipping, and storage before required use, to simplify and quicken the production process, some producers of devices to be may implement machine automated item bagging. However, machine automated bagging devices of the related art are often limited in their application and usefulness. For example, in the related art, there is often a large waste of materials used when forming the bags, and additionally, the machine automated bagging devices of the related art are limited by the size of the bag they are able to produce. Often the machine automated bagging devices of the related art are configured such that they are only capable of creating bags for one type of item to be bagged. In another example, conventional bagging may require premade

pouches of fixed sizes. An operator may manually trim the premade pouches to fit instruments to be bagged. The trimmed portions of the premade pouches are not used in the bagging of the instruments, and may be discarded. Therefore, conventional bagging may be tedious and/or wasteful, among other disadvantages. Thus, various aspects of the present disclosure may in part address these deficiencies (as well as others) through cooperative operation with implementation of advanced machine vision technology. Among other things, this technology may facilitate the identification of the item, device, or other similar instrument being packaged, and then the creation of a correspondingly sized, heat-sealed packages, which may not only reduce the production times of the bags, pouches, and/or peel pouches, but also may significantly reduce material waste.

According to aspects of the present disclosure, FIG. **1** illustrates various features of an example implementation of a bagmaker **100**, in accordance with aspects of the present disclosure. The bagmaker **100** may include a controller **1001** and a bag production device **1002**, wherein the controller **1001** may be in communication with the bag production device **1002**. In this example implementation, the controller **1001** may receive a plurality of commands **1003** from a command issuing device **1004**. The commands **1003** may be transmitted using USB protocol, RS-232, I2C, or any other suitable electronic communication protocol. For example, the commands **1003** may be sent from a separate computer or microprocessor; however, in another example, the commands **1003** may be generated by user input via an external or incorporated input mechanism such as buttons, keypad, touch screen, bar code (e.g., with preset commands), voice commands or a handheld device, such as mobile phone. Further, the commands **1003** may be interpreted by the controller **1001** and then implemented in the controlling of the bag production device **1002**.

As further illustrated in FIG. **1**, the bag production device **1002** may employ a range of sizes of tubing **1005**, such as in one or more rolls. Tubing **1005** may be for use in sterilization, wherein the tubing may be available from a variety of manufacturers, such as from the company Crosstex of Hauppauge, New York. In one example, as shown in FIG. **1**, the tubing **1005** may be configured to be in the form of one or more rolls. In use, for example, the tubing **1005** may first be cut to a desired length, wherein following, an item, such as a medical instrument, may be emplaced within the aforementioned cut tubing **1005**, and one or both ends of the cut tubing **1005** may then be sealed, such as with a heat sealing device, so that a bag, pouch, and/or peel pouch may thereby be formed. The cut and sealed tube may interchangeably be referred to as a bag, pouch or peel pouch herein. In one example implementation, the commands **1003** may direct the controller **1001** as to which tubing size to use, a desired length of the bag to produce, and any other pertinent information regarding bag production.

In the bag production device **1002** of FIG. **1**, internal electromagnetic and/or other components may permit the bag production device to manipulate and then seal and cut tubing **1005** from the one or more rolls. Each internal electromagnetic and/or other components may be individually addressable by the controller **1001**. The controller **1001** may direct the actions of an internal electromagnetic and/or other components in response to a command sent from the command issuing device **1004**. The sent command **1003** may include content that determines the operation of the addressed component.

FIG. **2** illustrates an example implementation of bag production device **100**, wherein bag production device **100** is depicted with a portion of its outer covering removed. As shown in FIG. **2**, bag production device **100** may further include tubing holders **1101**, wherein tubing holders **1101** may be configured to hold the tubing **1005** (FIG. **1**). Further, the tubing **1005** may be configured to be selectively inserted or otherwise fed into a plurality of module rollers **1102**. Bag production device **100** may also include a bag cutter **1103**, a secondary roller **1104**, and a heat sealer **1105**. In one example, one module roller **1102** for each roll of tubing **1005** may be provided, wherein the module rollers **1102** may be individually activateable, such that the any number of sterilization tubes **1005** may be manipulated contemporaneously, for example. The module roller **1102** and secondary roller **1104** may control the selective insertion of the tubing **1005**. The bag cutter **1103** may cut the tubing **1005** to form a bag, wherein the bag may be cut to a predetermined length. Finally, the heat sealer **1105** may be configured to seal the cut tubing **1005** at each cut end in order to create an enclosed volume.

FIGS. **3**A and **3**B show a front perspective view and rear perspective view, respectively, of various features of an example module roller **300** for use in accordance with aspects of the present disclosure. Module roller **300** may be configured to interoperate with a bag of a selected or otherwise specified width, wherein the bag width may be determined by the size of the item to be contained therein and/or available sizes of tubing engaged with the module roller **300**, such as tubing **1005** of FIG. **1**. In certain aspects of the present disclosure, the bagmaker **100** (FIG. **1**) may include multiple module rollers (e.g., module roller **300**), which in some implementations may each have a different width. Each of the module rollers may be configured for a bag of a certain width, for example. In one example implementation, as illustrated in FIGS. **3**A and **3**B, module roller **300** may be configured to interoperate with tubing **1005** configured to be 4 inches in width, for example. However, in other example implementations, module roller **300** may be configured to interoperate with tubing, such as tubing **1005** of FIG. **1**, of a variety of different widths. The module roller **300** may include a body or housing **1201**, the body **1201** being configured to house a drive shaft **1202** engaged with an electromagnetic clutch and/or other engaging feature **1203**. Further, module roller **300** may also include a clutch gear or similar interoperating feature **1204**, one or more roller gears **1205**, one or more rollers **1206**, and a bag feed slot **1207**. In one example, the roller gears **1205** may be comprised of a lower roller gear and an upper roller gear. In one example, the bagmaker **100** may be configured to include one module roller **300**. However, in an alternative example, bagmaker **100** may be configured to include a plurality of module rollers **300**. In the example of incorporation of a plurality of module rollers **300**, the plurality of module rollers **300** may be configured to interoperate, such that one of the plurality of module rollers **300** may be designated and otherwise configured to be a lead module roller. The lead module roller may interoperate with an electric motor **1208**, wherein the electric motor **1208** may be coupled to the drive shaft using a timing belt and pulley drive and/or any other suitable features for conveying rotational motion from a motor to a shaft. Consequently, the plurality of module rollers **300** may be configured to apply rotational motion via the Lead Module Roller, such that the entire system may interoperate with only a single motor **1208**. Specifically, the rotational motion applied to the drive shaft **1202** by the electric motor **1208** may further be applied to the drive shafts of additional modules (not illustrated in FIGS. **3**A and **3**B) using, for example, a shaft coupler **1209**.

The shaft coupler **1209** may securably fix the trailing end of the drive shaft **1202** of a first Module roller to the leading end of the drive shaft of a second module roller. The coupling of the module roller shafts may allow for a succession of multiple module rollers to be coupled together while only requiring one motor.

When the electromagnetic clutch **1203** of the module roller **300** is deactivated, the corresponding drive shaft **1202** may spin freely. However, when the electromagnetic clutch **1203** is activated, the previously free spinning component of the electromagnetic clutch **1203** may become engaged with the drive shaft **1202**, such that the electromagnetic clutch **1203** and the drive shaft **1202** may turn contemporaneously. Further, the clutch gear **1204** may be affixed to or otherwise engaged with such spinning component. The clutch gear **1204** in turn may engage the lower roller gear **1205***a*, such that the lower roller gear **1205***a* may then engage the upper roller gear **1205***b*. The roller gears **1205** may be fixed to the two rollers **1206**, and consequently the two rollers **1206** may spin in opposing rotational directions.

In one example, a roll of tubing **1005** (FIG. **1**) may be fed into module roller **300** through the bag feed slot **1207**, wherein the bag feed slot **1207** may be comprised of an opening, wherein the opening may have a width slightly wider than the width of the tubing **1005** (FIG. **1**). Further, the height of the opening of bag feed slot **1207** may be configured to be more than the thickness of the tubing **1005** (FIG. **1**) and less than 1/16", such that the tubing may be maintained in a flat configuration while being fed therethrough. In one example, when the bottom roller spins counter clockwise, the roll is unspooled. When the bottom roller spins clockwise, the unrolled tubing **300** may be pushed towards the roll.

According to various aspects of the present disclosure, further aspects **400** of an example bag cutter (e.g., bag cutter **1103** of FIG. **2**) are depicted in FIG. **4**. These aspects **400** include a body **1301**, wherein body **1301** may house or have fixed thereto a motor **1302** interoperable with a drive belt **1303**, belt idling pulleys **1308** and/or rollers (such as the rollers shown in FIGS. **1** and **3**), a linear rail **1304** with an affixed gear rack **1305**, a circular blade carriage assembly **1306**, and limit switches **1307**.

FIG. **5**, according to various aspects, illustrates in greater detail various features of the example circular blade carriage assembly **1306** of FIG. **4**. Specifically, the circular blade carriage assembly **1306** may include a carriage **1401**, wherein carriage **1401** may be matably engageable with the linear rail **1304** (FIG. **4**). Further, carriage **1401** may also include a circular blade **1402** and gear **1403** affixed to a shaft **1404**, wherein the gear **1403** may be matably connectable with the gear rack **1305**, as illustrated in FIG. **4**. Additionally, carriage **1401** may include one or more guides **1405**, wherein guides **1405** may be configured to position the tubing **1005** (FIG. **1**) for engagement with the blade **1402** to cut the tubing **1005** (FIG. **1**), and a belt clamp **1406**, wherein the belt clamp **1406** may be configured to securably fix the blade carriage assembly **1306** relative to the drive belt **1303** (FIG. **4**). In one aspect, the guides **1405** may be optional. When the motor **1302** (FIG. **4**) spins, the drive belt **1303** (FIG. **3**) may move accordingly. The point of attachment between the belt **1303** (FIG. **3**) and the belt clamp **1405** may be repositioned then pulled along the rail **1304** (FIG. **4**). If the circular blade carriage assembly **1306** (FIG. **4**) is pulled along the rail **1304** (FIG. **4**), the gear **1403** may engage with the rack **1305** (FIG. **4**), such that blade **1402** may be engaged in rotary motion. As the circular blade carriage assembly **1306** is positioned with respect to the rail **1304** (FIG. **4**), the carriage assembly **1306** may cuttingly engage tubing **1005** (FIG. **1**), wherein tubing **1005** (FIG. **1**) may span the distance between the module roller **1102** (FIG. **2**) and the secondary roller **1104** (FIG. **2**). The guides **1405** may lift the tubing **1005** (FIG. **1**) to the spinning blade cutter **1402**, such that the tubing **1005** (FIG. **1**) may be cut.

FIG. **6**, according to various aspects of the present disclosure, illustrates various features **600** of a secondary roller (e.g., secondary roller **1104** of FIG. **2**). Such features **600** may include a body **1501**, wherein body **1501** may be configured to house or have affixed thereto a motor **1502**. Motor **1502** may be configured to power one or more drive components **1503**, wherein drive components **1503** may be configured to interoperate with a plurality of rollers **1504**. In one example, drive components **1503** may be configured to be cylindrical rods that extend between a first side **1501***a* and a second side **1501***b*, wherein both sides **1501***a* and **1501***b* are included in body **1501**. Further, rollers **1504** may also be configured to have approximately cylindrical outer surfaces, wherein rollers **1504** may also include a central recess (not illustrated), such that rollers **1504** may be received upon drive components **1503** via the central recess. When motor **1502** is actuated, the motor **1502** may apply a rotary motion to the drive components **1503**, such that the top roller and the bottom roller may spin in rotationally opposed directions. Further, a bag received via the secondary roller may be gripped between pairs of top and bottom rollers such that the tangential motion of the gripped bag is in the same direction as the rotational motion of the rollers.

According to various aspects of the present disclosure, various aspects **700** of an example heat sealer (e.g., heat sealer **1105** of FIG. **2**) is illustrated in FIG. **7**. The depicted heat sealer **700** may include a body **1601**, wherein body **1601** may house and/or interoperate with a drive **1602**, a compression bar **1603**, one or more compression bar guides **1604**, a hot bar **1605**, and one or more hot bar mounts **1606**. Further, heat sealer **700** may also include a drive assembly, wherein the drive assembly may comprise a motor **1701**, a gear **1702**, and a rotary cam **1705** or other similarly operating feature, wherein the motor **1701**, the gear **1702**, and the rotary cam **1705** may be configured to interoperate. In one example implementation, the compression bar guides **1604** may include linear bearings. Compression bar guides **1604** may also or alternatively include other guiding features, such as slots for receiving corresponding shafts extending from or otherwise operatively engaging compression bar **1603** (see also FIG. **9** and corresponding description). The heat sealer **700** may exert a specified pressure in order to create a viable seal, wherein as the sealing area gets longer, the force exerted may need to be increased proportionally. Consequently, a driving mechanism for the heat sealer **700** (e.g., a motor, such as motor **1702** and the drive assembly shown in FIG. **8**) may need to be capable of producing such force required to create a viable seal.

In FIG. **8**, various features of the example drive **1602** of FIG. **7** are shown. As shown in FIG. **8**, drive **1602** may include a motor **1701**, wherein motor **1701** may be configured to have attached to a rotating shaft extending therefrom, or otherwise be engageable therewith, a pinion gear **1702**. Further, drive **1602** may also include a main shaft **1704**, wherein main shaft **1704** may be configured to have a spur gear **1703** received thereon, as well as a rotary cam **1705**. As the motor **1701** spins, the pinion gears **1702** may rotationally engage the spur gear **1703**, such that rotary cam **1705** may rotate therewith. As the rotary cam **1705** rotates, the vertical radius **1704**, as defined as the farthest edge of the rotary cam

1705 as measured from the outer surface of the main shaft 1704, may increase in length and consequently push up on the compression bar 1603.

FIG. 9 illustrates various features of the example compression bar 1603 of FIG. 7. The compression bar 1603 may comprise a cam roller 1801, wherein cam roller 1801 may be configured to interoperate with structural element 1802. Structural element 1802 may further include a heat resistant non-stick surface 1803. Further, compression bar 1603 may include one or more linear shafts 1804, wherein linear shafts 1804 may be configured to slide within or otherwise engage corresponding compression bar guides 1604 (not illustrated). In some examples, the heat resistant non-stick surface 1803 may be or include a strip of silicone rubber. The cam roller 1801 may rest upon or otherwise be engaged by the rotary cam 1705 (FIG. 8), wherein as the rotary cam 1705 rotates, the cam roller raises and lowers the structural element 1802 via the linear shafts 1804, depending on the cam's rotational position. To perform a seal, the rotary cam 1705 rotates until the compression bar 1603 pushes against the hot bar 1605, such that the compression bar 1603 may be held in place for a prescribed period of time. Further, rotary cam 1705 may then rotate so as to allow retraction the compression bar 1603 (e.g., due to gravity and/or a spring or other biasing element that may bias the compression bar 1603 away from the hot bar 1605.

Various example features of the hot bar 1605 of FIG. 7 are further depicted in FIG. 10. The hot bar 1605 may include a structural element 1901, an insulator 1902, one or more spacers (not shown in FIG. 10, which may be located, for example, between the structural element 1901 and the sealing bar 1903), a sealing bar 1903, wherein sealing bar 1903 may include one or more heating elements 1904, and a temperature measurement device 1905. The sealing bar 1903 may be heated by the one or more heating elements 1904. Further, hot bar 1605 may be made of Aluminum and/or any other suitable material capable of withstanding the required temperatures of the sealing process. In some example implementations, the heating elements 1904 may be or include insertion heaters powered by, for example, an alternating current (AC) voltage source, and the temperature measurement device 1905 may be or include a K-Type thermocouple (although other thermocouple types and/or other alternative devices and/or methods of temperature measurement may be implemented), wherein the K-Type thermocouple may be affixed to the sealing bar 1903 via a fastening mechanism, such as a bolt or screw, for example. The thermocouple or other temperature measurement device 1905 may be attached or otherwise securably fixed in a location such that its readings accurately correspond to the surface temperature of a sealing face 1906. Temperature control may be achieved by various temperature control features, wherein the temperature control features may include feeding temperature data from the temperature measurement device 1905 into a controller (e.g., controller 1001 of FIG. 1) that may include algorithmic based operation. In one example, the algorithmic operation may convert the difference between the received temperature data and the desired temperature value into a pulse width modulation signal for the heating elements 1904.

To implement control of the control system for the bag-maker device system, a plurality of configuration parameters may be employed. For example, the presence and location of the different cross-sectional sizes ("widths") of tubing 1005 (FIG. 1) may be important to the production of an appropriately sized bag, pouch, and/or peal pouch for sterilization. Referring to FIG. 11, in an example implementation, four rolls of tubing 2001 shown at the labeled locations 2002, '1', '2', '3', and '4' may be used. The rolls of tubing 2001 may be located at positions corresponding to the locations of roller modules. In the example implementation illustrated in FIG. 11, the roll of tubing 2001 at position '2' may be about 4 inches wide, for example, and correspondingly located at a 4 inch wide roller module; however, any suitable tubing size may be located in any location. In one example, the presence and location of the different sizes of tubing 1005 may be maintained as computer readable data 210 within a configuration file 212, as further described in relation to FIG. 12. For each line of configuration file 212 in FIG. 12, the left hand side of the equals sign may include the location 2101 of the roll of tube 2001 (FIG. 11), and the data on the right hand side of the equals sign may correspond to the width of the bag 2102 (FIG. 11). Other features for storing data may also be implemented, such as via storage and/or access of this or other data in a data repository, as variables in software, or any other method or features familiar to those skilled in the art.

As further shown in FIG. 11, the locations 2002 may also refer to various features relating to an electronic location for purposes of electrical and/or computer operation. For example, the electronic location may include an electrical device location having a corresponding electrical or electronic coupling, for purposes of operation relating to device(s) at locations 2002. In one example, the roller modules may be activated by an electromagnetic clutch and/or other engaging feature 1203 (FIG. 3A), wherein electromagnetic clutch and/or other engaging feature 1203 (FIG. 3A) may be activated by a current passing through an electric coil and/or other operational control feature housed internally within the clutch and/or other engaging feature 1203 (FIG. 3A). The current to the coil or other such control feature may be governed, for example, by one or more transistors and/or other suitable electronic components activated via a controller (e.g., controller 1001 of FIG. 1). Port pins of or otherwise governable via the controller 1001 (FIG. 1), for example, may each correspond to the electronic location assigned to a specific physical location (e.g., locations 2002). In one example implementation according to various aspects of the present disclosure, a port pin corresponding to a particular location have corresponding computer readable data 220 within a configuration file 222 structured as depicted in FIG. 13. For each line of the configuration file 220 as shown in FIG. 13, the left hand side of the equals sign may correspond to a location 2201 (FIG. 11), and on the right hand side of the equals sign may be a value representing or otherwise corresponding to the port pin accessed by the controller (e.g., controller 1002 of FIG. 1). However, in other example implementations, other methods and/or features of storing the aforementioned data may also be utilized, such as via storage and/or access of this or other data in a data repository, as variables in software, or any other method or features familiar to those skilled in the art.

Other parameters that may be used for bag production include those relating to the creation of the seal. Various such example parameters depicted in FIG. 14 may include some combination of the temperature of the hot bar (e.g., hot bar 1605 of FIGS. 7 and 10), the bag material, the pressure applied by the compression bar 1603, and the length of time for which the desired sealing pressure is maintained, or other variable parameters, for example. In one example as shown in FIG. 14, the temperature of the hot bar 1605 (FIG. 10) may be set to a specific temperature degree 2301. In another example, the user may select the bag material, wherein the temperature of the hot bar (e.g., hot bar 1605 of FIG. 10)

may be determined by reference to a lookup table containing corresponding suggested sealing temperatures or similarly operating other method employed to determine the appropriate temperature. In yet another example, the pressure (e.g. pressure value **2302** shown in FIG. **14**) applied by the compression bar (e.g., compression bar **1603** of FIGS. **7** and **9**) may be set by a user or determined by the system, for example, based on parameters of the bag material/type involved. For example, the user may select the bag material and a lookup table containing corresponding pressures may be employed. Further, in one example, the length of time (e.g., seal time value **2303** shown in FIG. **14**) for which the desired sealing pressure is maintained may be set by a user or determined by the system.

Additionally, parameters that size bags appropriately may also need to be utilized and/or accounted for with regard to various operations and/or functions, in accordance with various aspects of the present disclosure. In one example, an instrument that has been placed within and sealed into tubing (e.g., tubing **1005** of FIG. **1**) is representatively illustrated in FIG. **15**. A formed bag may be configured to include a width of approximately 3 inches, for a particular instrument in one example; however the useable width of the bag may be lessened by the width of a factory made seal **2401**. Further, the length of the bag may be configured to be approximately 6 inches, for the particular instrument in this example; however the useable length may also be lessened by the width of the bagmaker seal **2402**. The useable length of the bag may be further reduced by required padding between the top and bottom of the instrument and the seals. Additionally, a length of bag is in some cases desired past the seal opposite the contents of the sealed volume. The extra length beyond the seal may allow for easier opening of the sealed pouch. In addition, in one example, an amount of padding may be included within the formed bag between the packaged instrument and the seals **2403**.

When forming a bag for the packaging of devices that may be sterilized, such as medical instruments, other parameters related to the dimensional characteristics of the bag production device may also be considered and/or accounted for. For example, according to various aspects of the present disclosure, FIG. **16** representatively illustrates a cross sectional view of various features **160** of an example bagmaker (e.g., bagmaker **100** of FIGS. **1** and **2**), wherein such features **160** may include module roller rolls **2501**, a cutter blade **2502**, secondary roller rolls **2503**, and a heat sealer face **2504**. In one example, as a first stage in the production of a bag, a first end of a roll of tubing (e.g., tubing **1005** of FIG. **1**) may be engaged by the module roller rolls **2501**, at some distance away from the cutter blade **2502**. Following, the end of the bag engaged by the module roller rolls **2501** may be drawn a distance to sealer **2504**, wherein the distance to sealer **2504** may be defined as the distance from the starting location of the tubing in the module roller rolls **2501** to a position such that the end of the tubing may be at least slightly past the far edge of the sealer face **2504** (e.g., left side of sealer face **2504** as shown in FIG. **16**). After the tubing has been cut (e.g., via cutter blade **2502**), the cut portion of the tubing for forming a bag may be ejected from the bag production device (e.g., bagmaker **100** of FIGS. **1** and **2**). Thus, the cut end of the tubing may move an eject distance, wherein the eject distance may be defined as at least the distance from the cutter blade **2502** to a point where the bag is no longer engaged by the secondary roller **2503**. Additionally after the tubing has been cut, it may be desirable for the remainder of the tubing drawn through the module roller rolls **2501** to be retracted from the path of the cutter blade **2502**. Consequently, the end of the remaining tubing extending through the module roller rolls **2501** may be moved a retract distance, wherein the retract distance may be defined as the distance from the cutter blade **2502** to a point where the remaining tubing is still engaged by the module roller rolls **2501**.

FIG. **17** shows various elements of a flow chart **170** for an example method of production of a bag by a bagmaker, in accordance with aspects of the present disclosure. At **2601**, the clutch corresponding to the desired bag width may be activated. At **2602**, the activated module and second roller may advance the tubing to the sealer. Once the tubing **1005** (FIG. **1**) is positioned by the activated module and advance via the second roller, a seal may be created, such as by a heat sealer. At **2604**, the tubing **1005** (FIG. **1**) may be advanced to its full length for being cut. For example, along the lines as shown in FIG. **16**, the activated module and second roller may further advance the tubing such that the length of the tubing from the path of the cutter to the far end of the seal is approximately equal to the total desired bag length. For example, the desired bag length may include a length determined based on an object to be contained within the bag, such as a surgical instrument. The bag length may be determined based on one or more dimensions for the surgical instrument, which may be received, for example, from an instrument inventory system. For additional instrument inventory system related details, see, e.g., Applicant's co-pending U.S. patent applications, each of which is hereby incorporated by reference herein: U.S. patent application Ser. No. 14/620,084 titled "Instrument Inventory System and Methods" having inventors Russell BAKER, et al., filed Feb. 11, 2015; U.S. patent application Ser. No. 15/068,420 titled "System and Methods for Packaging Instruments" having inventors Russell BAKER, et al., filed Mar. 11, 2016; and U.S. patent application Ser. No. 16/397,178 titled "Object Recognition and Data Retrieval System" having inventors Russell BAKER, et al., filed Mar. 29, 2019.

In an aspect of the present disclosure, the instrument inventory system may include at least one user interface, at least one instrument interface, an instrument processor and a database storing instrument records. The instrument inventory system may include a training function that enables the system to create a data record, such as for new instruments when the system encounters new instruments. The at least one instrument interface may include one or more of an identification reader that is able to read instrument identifications, such as labels and electronic tags, a physical data interface that is able to identify the instrument through physical movement of the instrument, and/or a visual instrument identification system. In some example implementations, the instrument system may receive sensor data. In some example implementations, the instrument system may also receive user entered data. The instrument processor may analyze the data associated with an instrument being processed and the instrument system may add to instrument data in the database.

Aspects of the present disclosure may include an object recognition and data retrieval system and/or methods of operation thereof. An example implementation of an object recognition and data retrieval system may be provided that uses a digital representation of a physical object to retrieve data related to that object. For example, the system may compare stored digital representations of physical objects to an object under examination (e.g., imaging/image feature recognition) to determine the type of object. Once the type is identified, data related to the object may be retrieved. The object recognition and data retrieval system may example,

be configured to create and manipulate specific pieces of the data retrieved. The object recognition and data retrieval system may be configured to share object data with other, target storage systems and/or other features. The shared object data may be used by the target storage system to store the objects, for example.

Another aspect of the present disclosure may include a system for packaging instruments. The system for packaging instruments may include an input for receiving instrument identification data. The system may further include an instrument processor coupled to the input. The instrument processor may include a database and an instrument analyzer. The database may store instrument type data, instrument packaging data and package labeling data. The instrument analyzer may identify instrument type and determine instrument packaging and labeling using data stored in the database, for example. The instrument analyzer may further determine instrument handling, packaging and labeling instructions. An output coupled to the instrument processor may send the handling, packaging and labeling instructions to at least one external device. The at least one external device in various implementations may include a labeler, a packager and an instrument transfer device.

Once positioned via the advance of **2604**, at **2605**, the tubing may be cut. For example, the cutter may be employed to sever the tubing at the determined location. At **2606**, the tubing **1005** (FIG. **1**) may be ejected. For example, the second roller may eject the just created bag portion of the tubing **1005** by advancing the tubing **1005** the eject distance. At **2607**, the remaining, uncut portion of the tubing **1005** may be retracted. For example the module roller rolls may retract the uncut tubing **1005** by drawing the tubing **1005** back a retract distance. Though the above elements **2606** and **2607** are described sequentially above, such elements may occur contemporaneously or in reverse order, for example. At **2608**, the clutch may be deactivated.

FIG. **18** shows various aspects of a flow chart **180** for an example method of bag production, wherein a double bagging technique may be employed. Specifically, double bagging may refer to placing an item inside of a first pouch, wherein the item inside the first pouch and the first pouch are both then additionally placed within a second pouch. At **2701** of flow chart **180**, the cutter may be positioned adjacent to the module of the inner bag, yet distal to the outer bag. At **2702**, the clutches for both inner and outer bags may activate. At **2703**, the second roller and both activated module rollers may advance both bags the appropriate distance for operation of the heat sealer. At **2704**, the heat sealer may contemporaneously seal both bags. At **2705**, the second roller and both activated module rollers may further advance both sizes of tubing **1005** (FIG. **1**) such that the length of tubing **1005** (FIG. **1**) from the path of the cutter to the far end of the seal made previously is approximately equal to the desired length of the inner bag. At **2706**, the cutter may traverse a distance such that it cuts the inner bag only, stopping the circular blade assembly before it encounters the second bag. At **2707** the clutch for the inner bag may deactivate. At **2708**, the second roller and module roller corresponding to the outer bag may advance the outer bag tubing **1005** an additional length factor sufficient for the inner bag to fit inside of the outer bag. Should the additional length factor equal or exceed the eject distance, the first bag may also eject at **2708**. At **2709**, the cutter may cut the second bag. At **2710**, the clutch for the module roller of the inner bag may activate. With both clutches activated once again, the second roller may eject the second bag at **2711**, and the activated modules may retract both bags at **2712**. The flow chart **180** may conclude with the clutches for both bags deactivating **2713**.

FIG. **19** shows a flow chart **190** of an example method **190** for producing bags from a tubing stock, wherein the method may include an input device configured to input commands from a human user, according to various aspects of the present disclosure. In one example, the system may comprise a bagmaker, wherein the bagmaker may include a command issuing device configured for selective user input. The command issuing device may thereby allow for human control of the system. Human interaction with the user input device may generate content or other similar information for a plurality of commands (e.g. the commands **1003** of FIG. **1**) which may be interpreted by a controller (e.g. the controller **1001** also of FIG. **1**). In one example, the user input device may be incorporated into the body of the bag production device and may include an input or output device such as buttons, keypad, touch screen, LCD screen, microphone or other voice input, or any combination thereof. To begin the example method **190** as shown in FIG. **19**, a message may be displayed to the user requesting the user select the desired bag width **2801**. The system may then be configured to display one or more widths that have been installed and configured. At **2802**, the user may select the desired width. Next, at **2803**, the system may display a message to the user requesting the user enter the desired bag length. At **2804**, the user may enter the desired length of the bag. At **2805**, the system may request that the user enter a quantity value for the number of bags to produce. At **2806**, the user may enter a quantity value. Upon conclusion of the bag criteria entry, the user input device may send commands to the controller to make a bag **2807**, for example, in accordance with aspects of the bag production processes described in FIGS. **17** and **18**.

FIG. **20** shows a flow chart **200** of an example method for automating peel pouch production **200**. At **2901**, the item, such as an instrument or other similar devices, may be determined. Following, at **2902**, the required pouch size may be determined. At **2903**, the content for the commands sent to the controller from the command issuing device may be generated from the desired pouch size. Then, at **2904**, the bag may be produced. Finally, at **2905**, the successful production of an appropriately sized bag may be either confirmed or negated.

FIG. **21** shows a representative diagram of various aspects of a system **210** for operating an example bagmaker for automating the packaging of items, such as surgical instruments, into bags or pouches, in accordance with aspects of the present disclosure. The system **210** for operating a bagmaker **3010** in FIG. **21** is similar to features relating to operation of the bagmaker **100** of FIG. **1**, but may include additional features, such as a Graphical User Interface (GUI) **3001**, wherein the GUI **3001** may be configured for accepting user input and displaying system messages. Further, the GUI **3001** may also interoperate with a data repository **3002** for storing system data, and a processor **3003** for issuing commands **3014** to a controller **3012**, wherein controller **3012** may be similar to the controller **1001** of FIG. **1**.

FIG. **22** shows various features of one example GUI interface screen for the GUI **3001** of FIG. **21**, wherein such features may include a plurality of search criteria, for example. In one example implementation, search criteria may be entered using an external keyboard, touch screen keyboard, voice activation, or any other suitable devices and/or methods for submitting text to a computer. Following, search results may be shown in the matching results area

3102, including one or more match buttons 3103, wherein the match buttons 3103 may provide selectable results from the search. One or more of the match buttons 3103, for example, may be selected with a mouse click, touch screen button press, or other input; or, for example, the search results in the match buttons 3103 may be numbered to allow for selection using a numeric keypad or other numeric selection method or features.

FIG. 23 representatively illustrates various features of an example database configuration 230 for use in accordance with aspects of the present disclosure. Database 230 may utilize a database management system, such as MySQL made by Oracle Corporation of Cupertino, California; however, other database management systems may be used in other examples. FIG. 23 depicts two data repositories 3201, 3202, including a first data repository 3201 configured for item and/or instrument data, and a second data repository 3202 configured for Instrument Manufacturer Identification Numbers (IMIN). The instrument and/or item data repository 3201 may include, for example, a first column 3203 for instrument and/or item name, a second column 3204 for preferred bag width, a third column 3205 for preferred bag length, and a fourth column 3206 for instrument and/or item identification (ID). In an alternative example, any number of columns (or other suitable data organizational structure) may be implemented to account for a plurality of information. The IMIN data repository 3202 may be configured to include, for example, a plurality of columns, such as a first column 3207 for identification number, a second column 3208 for manufacturer identification information, and a third column 3209 for instrument and/or item identification information, such that column 3209 may be configured to correlate the IMIN data repository 3202 entry to an instrument type in the instrument and/or item data repository 3201.

The example implementations of the system shown in FIG. 23 may be used in accordance with the flow chart illustrated in FIG. 20, for example.

A flow chart 240 depicting an example method for carrying out an example search and select process is shown in FIG. 24. Flow chart 240 may begin at 3301, wherein the user may enter a sequence of characters into the search bar 3101. At 3302, as each character is entered, a processor (e.g., processor 3003 of FIG. 21) may search an instrument and/or item data table (e.g., instrument table 3201 of FIG. 23) for instrument and/or item names with matching character sequences. However, in other example implementations, the processor may simultaneously search an IMIN table (e.g., IMIN table 3202 of FIG. 23) for identification numbers containing the character sequence. Instruments and/or items that match the text sequence may be collected and sorted 3303. In one example, sorting may be alphabetical; however, in other examples, sorting by frequency may be implemented. In yet another example, sorting order may be determined by frequency of use, by time of day, or by some combination thereof. Following, at 3304, sorted instruments and/or items may be presented (e.g., in match buttons area 3102 of FIG. 22). Finally, at 3305, the user may select an instrument and/or item type, wherein in one example, the selected instrument and/or item may be a desired instrument and/or item type.

FIG. 25 shows a flow chart 250 depicting an example method for bag size determination. The method shown in flow chart 250 may commence at 3401, wherein a determination may be made (e.g., via software) as to whether the selected instrument and/or item type has a preferred bag size stored in the instrument and/or item table. If it is determined that the selected instrument and/or item type has a preferred bag size stored in the instrument and/or item table, the data may then be retrieved 3402 (e.g., via software). However, if it is determined at 3401 that the selected instrument and/or item type does not have a stored bag size, at 3403, a request may be made for the desired bag width. For example, the processor may command the GUI to display a numeric key pad along with a pop-up requesting the user enter a desired bag width. Following, at 3404, a value for the desired bag width may be entered. At 3405, a value for the desired bag length may be requested. For example, the processor may command the GUI to display a numeric key pad along with a popup requesting the user enter a desired bag length, wherein following at 3406, a value for a bag length may be entered. At 3407, a determination may be made as to whether the bagmaker has a tube width within the desired range. If the bagmaker does have a tube width within the desired width range, the determined width and entered length may be stored for use in the bag production 3408. If the bagmaker does not have at tube width within the desired width range, the bag production size is determined not to be available 3409.

FIG. 26 shows a flow chart for an example process 260 for generating the appropriate content for the controller commands from the desired bag size. In one example, the bag module rollers may share a motor. Further, for example, module rollers may have an electromagnetic clutch, wherein the electromagnetic clutch may be activated to harness the rotary motion of the shared motor. For this example, at 3501, the software may refer to a roll location configuration file, such as the roll location configuration file as depicted in FIG. 11. At 3502, the software may search the roll location configuration file for a width corresponding to the desired bag width. Upon finding the matching width, the corresponding location may be recorded 3503. Following, at 3504, the software may access the location of a port pin configuration file, such as the port pin configuration file as depicted in FIG. 12. Next, at 3505, the software may retrieve the port pin corresponding to the recorded location. To employ the module roller possessing the desired bag width, a command may be sent to the controller which activates the retrieved port pin.

According to various aspects of the present disclosure, FIG. 27 is a flow chart 270 illustrating an example method for a process of bag validation. As shown in FIG. 27, at 3701, a message indicating that a job is completed may be displayed. At 3702, an input may be made as to whether the produced bag is useable. If the bag is useable, the method may then proceed to 3703, wherein the data processing for the just processed item and produced bag may be stored into the data repository 3703 and inventory may be updated to reflect the completed product. If at 3702 a determination is made that the produced bag is not usable, a reason for unusability may be input 3707. At 3704, a determination may be made as to whether the just processed item type has values for stored bag size in the data repository. If the just processed item type does not have values for stored bag size in the data repository, the method may proceed to 3705, wherein the just used and validated bag dimensions may be stored in the data repository. In one example, following a successful bag production, a label may be printed for placement upon the just produced pouch 3706.

FIG. 28 illustrates various aspects of an example system 280 for automating the packaging of items, such as surgical instruments, into bags or pouches, wherein the packaged item may be sterilized. The bagmaker depicted in FIG. 28 may include a command issuing device, wherein the command issuing device may include a GUI 3801, wherein GUI

3801 may be configured for accepting user input and displaying system messages, a data repository 3802, configured for storing system data, an item imaging device 3804, for obtaining imaging data of instrumentation for the item, and a processor 3803 for controlling the GUI 3801, accessing the data repository 3802, controlling and interpreting the data from the item imaging device, and issuing commands to the controller 3001.

Further, the various components of the system 280 of FIG. 28 may carry out functionality reflected in the various flowcharts herein. Further to that functionality, the GUI of the example depicted in FIG. 28 may have a process button as depicted in FIG. 29, wherein the process button may commence a procedure for capturing an image of an object and collecting the data. Additionally, further to the functionality of the data repository 3802, the example system 280 depicted in FIG. 28 may include a recognition data table 300, as illustrated in FIG. 30. Columns stored in the recognition data table 300 may include but are not limited to item identification 4001 and various values 4002, wherein values 4002 may describe the shape of the item such as length, width, etc.

In the example system 280 depicted in FIG. 28, item image recognition may additionally be used for item determination 2901 (FIG. 20), wherein various aspects of a flowchart of an example item image recognition process are depicted in FIG. 31. As shown in FIG. 31, at 4101, an item may be selected and subsequently placed on the item platform. Following, at 4102, a process button may be engaged, such as by a user pressing the process button 290 depicted in FIG. 29. In response to the user action, the method may proceed to 4103, wherein the processor may receive imaging data from the instrument imaging device. At 4104, the processor may analyze the image data and produces recognition data. Following, at 4105, the processor may retrieve one or more item types from the data repository that contain recognition data similar to that of the just imaged item. The retrieved item types may then be scored and then sorted by highest score and/or other similar value measurement. Upon assortment, the retrieved item types may be displayed in the determined order 4106, such as in the match buttons area 3102 of FIG. 22. Finally, at 4107, the instrument that matches the just processed instrument may be selected.

FIG. 32 shows a flow chart 320 of an example method for determination of visual identification of an item type and bag size. First, at 4201, a determination may be made as to whether the selected item type has a preferred bag size stored in the memory. If the selected item type does have a preferred bag size stored in the memory, the corresponding data may be received at 4202. However, if the selected item type does not have a stored preferred bag size, the item length and width characteristics may be retrieved from the image at 4203. Following, at 4204, those values, as well as the values for the seal widths seal and minimum and maximum padding, may be used to create a range for the desired bag width and length. At 4205, a determination may be made as to whether the bagmaker has a tube width within the desired range for making the bag. If it is determined has the desired range of tube width, the width and calculated length are stored for use in the bag production 4206. If it is not determined at 4205 that the desired range of tube width is available, the bag production size may be determined to not be available in a step 4207.

Aspects of the present disclosure may be implemented using hardware, software, or a combination thereof and may be implemented in one or more computer systems or other processing systems. In an aspect of the present disclosure, features are directed toward one or more computer systems capable of carrying out the functionality described herein. Various aspects of an example of such a computer system 4300 are shown in FIG. 33.

Computer system 4300 includes one or more processors, such as processor 4304. The processor 4304 may be coupled to a communication infrastructure 4320 (e.g., a communications bus, cross-over bar, or network). Various software aspects are described in terms of this example computer system. After reading this description, it will become apparent to a person skilled in the relevant art(s) how to implement aspects hereof using other computer systems and/or architectures.

Computer system 4300 may include a display interface 4330 that forwards graphics, text, and other data from the communication infrastructure 4320 (or from a frame buffer not shown) for display on a display unit 4340. Computer system 4300 may include a main memory 4350, such as random access memory (RAM), and may also include a secondary memory 4360. The secondary memory 4360 may include, for example, a hard disk drive 4370 and/or a removable storage drive 4380, representing a floppy disk drive, a magnetic tape drive, an optical disk drive, etc. The removable storage drive 4380 may read from and/or write to a removable storage unit 4390 in a well-known manner. Removable storage unit 4390, represents a floppy disk, magnetic tape, optical disk, etc., which may be read by and written to removable storage drive 4380. As will be appreciated, the removable storage unit 4318 may include a computer usable storage medium having stored therein computer software and/or data.

Alternative aspects may include secondary memory 4360 and may include other similar devices for allowing computer programs or other instructions to be loaded into computer system 4300. Such devices may include, for example, a removable storage unit 4390 and an interface 4395. Examples of such may include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an erasable programmable read only memory (EPROM), or programmable read only memory (PROM)) and associated socket, and other removable storage units 4390 and interfaces 4395, which allow software and data to be transferred from the removable storage unit 4390 to computer system 4300.

Computer system 4300 may also include a communications interface 4324. Communications interface 4234 may allow software and data to be transferred among computer system 4300 and external devices. Examples of communications interface 4324 may include a modem, a network interface (such as an Ethernet card), a communications port, a Personal Computer Memory Card International Association (PCMCIA) slot and card, etc. Software and data transferred via communications interface 4324 may be in the form of signals 4328 which may be electronic, electromagnetic, optical or other signals capable of being received by communications interface 4324. These signals 4328 may be provided to communications interface 4324 via a communications path (e.g., channel) 4326. This path 4326 may carry signals 4328 and may be implemented using wire or cable, fiber optics, a telephone line, a cellular link, a radio frequency (RF) link and/or other communications channels. As used herein, the terms "computer program medium" and "computer usable medium" refer generally to media such as a removable storage drive 4380, a hard disk installed in hard disk drive 4370, and/or signals 4328. These computer pro-

gram products may provide software to the computer system **4300**. Aspects of the present disclosure are directed to such computer program products.

Computer programs (also referred to as computer control logic) may be stored in main memory **4350** and/or secondary memory **4360**. Computer programs may also be received via communications interface **4324**. Such computer programs, when executed, may enable the computer system **4300** to perform the features in accordance with various aspects discussed herein. In particular, the computer programs, when executed, may enable the processor **4310** to perform the features in accordance with aspects of the present disclosure. Accordingly, such computer programs may represent controllers of the computer system **4300**.

Where aspects of the present disclosure may be implemented using software, the software may be stored in a computer program product and loaded into computer system **4300** using removable storage drive **4314**, hard drive **4312**, or communications interface **4320**. The control logic (software), when executed by the processor **404**, may cause the processor **404** to perform the functions described herein. In another aspect of the present disclosure, the system may be implemented primarily in hardware using, for example, hardware components, such as application specific integrated circuits (ASICs). Implementation of the hardware state machine so as to perform the functions described herein will be apparent to persons skilled in the relevant art(s).

In yet another variation, aspects of the present disclosure may be implemented using a combination of both hardware and software.

FIG. **34** is a block diagram of various example system components, for use in accordance with aspects of the present disclosure. FIG. **34** shows a communication system **4400** usable in accordance with aspects hereof. The communication system **4400** shown in FIG. **34** includes one or more accessor **4460** (also referred to interchangeably herein as one or more "users") and one or more terminals **4442**. In one aspect, data for use in accordance with aspects of the present disclosure is, for example, input and/or accessed by accessor **4460** via terminal **4442**, such as personal computers (PCs), command issuing devices including Graphical User Interfaces (GUIs), minicomputers, mainframe computers, microcomputers, telephonic devices, or wireless devices, such as personal digital assistants (PDAs), smart phones, or other hand-held wireless devices coupled to a server **4443**, such as a PC, minicomputer, mainframe computer, microcomputer, or other device having a processor and a repository for data and/or connection to a repository for data, via, for example, a network **4444**, such as the Internet or an intranet, and couplings **4445**, **4446**, **4464**. The couplings **4445**, **4446**, **4464** include, for example, wired, wireless, or fiber optic links. In one example, bag cutter **4466** may be coupled to network **4444** via coupling **4464** and be therefore able to receive input data from user **4460**, such that the user may be able to input bag size parameters, such as a desired length or width, and other data for operation of the cutter, for example. In another variation, the method and system in accordance with aspects of the present disclosure may operate in a stand-alone environment, such as on a single terminal. While the aspects described herein have been described in conjunction with the example aspects outlined above, various alternatives, modifications, variations, improvements, and/or substantial equivalents, whether known or that are or may be presently unforeseen, may become apparent to those having at least ordinary skill in the art. Accordingly, the example aspects, as set forth above, are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the disclosure. Therefore, the disclosure is intended to embrace all known or later-developed alternatives, modifications, variations, improvements, and/or substantial equivalents.

Thus, the claims are not intended to be limited to the aspects shown herein, but are to be accorded the full scope consistent with the language of the claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more." All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. No claim element is to be construed as a means plus function unless the element is expressly recited using the phrase "means for."

Further, the word "example" is used herein to mean "serving as an example, instance, or illustration." Any aspect described herein as "example" is not necessarily to be construed as preferred or advantageous over other aspects. Unless specifically stated otherwise, the term "some" refers to one or more. Combinations such as "at least one of A, B, or C," "at least one of A, B, and C," and "A, B, C, or any combination thereof" include any combination of A, B, and/or C, and may include multiples of A, multiples of B, or multiples of C. Specifically, combinations such as "at least one of A, B, or C," "at least one of A, B, and C," and "A, B, C, or any combination thereof" may be A only, B only, C only, A and B, A and C, B and C, or A and B and C, where any such combinations may contain one or more member or members of A, B, or C. Nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims.

The invention claimed is:

1. A system for making a bag, the system comprising:

a bagmaker, the bagmaker including:

at least two roller modules for supplying and directing feeding of a plurality of widths of tubing;

a motor creating a motion of one of the at least two roller modules, the selected one of the at least two roller modules being interoperable with a corresponding selected one of the plurality of widths of tubing to form a bag of a determined width from the selected tubing, the determined width corresponding to a size of an item to be contained in the bag;

a bag cutter;

a heat sealing device; and

a controller configured to selectively control operation of the bagmaker to:

feed a selective length of the selected tubing and form the bag of the determined width from the selected tubing;

cut the selected tubing; and

heat seal the selected tubing to form at least one closed and sealed end thereof.

2. The system of claim **1**, wherein the controller is further configured to selectively control operation of the bagmaker to:

prior to cutting the tubing, feed an additional selective length of the tubing, the additional selective length corresponding to the selective length of the tubing;

after cutting the tubing, eject the cut and heat sealed tubing from the bagmaker; and

retracting a remaining uncut portion of the tubing.

3. The system of claim **1**, wherein the system is configured to interoperate with an instrument processor.

4. The system of claim **3**, wherein the instrument processor includes a device for optical identification of an instrument.

5. The system of claim **1**, wherein the controller is selectively controlled via a command issuing device, the command issuing device accessing a processor and a data repository.

6. The system of claim **1**, wherein each roller module is for making a respective width of the bag.

7. The system of claim **6**, wherein the one of the at least two roller modules comprises:

a body;

a drive shaft located within body; and

a shaft engaging feature for selectively engaging the drive shaft.

8. The system of claim **1**, wherein the bag cutter comprises:

a body;

a drive belt;

a linear rail; and

a blade carriage selectively moveable along the linear rail via the drive belt.

9. The system of claim **1**, wherein heat sealing device comprises:

a housing;

a hot bar;

a compression bar;

a heat sealer drive having a rotatable drive shaft; and

a cam operable via the rotatable drive shaft;

wherein the compression device is selectively moveably interoperable with the hot bar via engagement of the cam with the compression device.

10. The system of claim **9**, wherein the cam translates rotational motion of the drive rotatable shaft into linear movement of the compression bar.

11. The system of claim **1**, wherein a first width of a first roller of the at least two module rollers is different from a second width of a second roller of the at least two module rollers.

12. The system of claim **1**, further comprising:

a Graphical User Interface (GUI) interoperable with at least one of the bagmaker or the controller, wherein the GUI is configured to receive input from a user for controlling bagmaker.

13. The system of claim **1**, wherein the controller is further configured to determine the selective length of the tubing.

14. The system of claim **1**, wherein a predetermined width of tubing is fed using one of the at least two roller modules.

15. The system of claim **1**, wherein the bagmaker receives a command from the controller, the command comprising: a size of tubing to be used for making the bag, and a variably selectable length of the bag to be made.

16. The system of claim **1**, wherein each roller module of the at least two roller modules is individually actionable.

17. The system of claim **1**, wherein one of the at least two roller modules comprises:

a body for housing a drive shaft engaged with a clutch;

a clutch gear;

a roller gear including a lower roller gear and an upper roller gear for causing the motion of one of the at least two roller modules thereby to feed the tubing;

a roller; and

a bag feed slot.

18. The system of claim **1**, wherein the at least two roller modules are rotatable about a single axis.

19. A system for making a bag, the system comprising:

a bagmaker, the bagmaker including:

at least two roller modules for supplying and directing feeding of a plurality of widths of tubing;

a motor creating a motion of one of the at least two roller modules, the selected one of the at least two roller modules being interoperable with a corresponding selected one of the plurality of widths of tubing to form a bag of a determined width from the selected tubing, the determined width corresponding to a size of an item to be contained in the bag;

a bag cutter;

a heat sealing device; and

a controller configured to selectively control operation of the bagmaker to:

feed a selective length of the selected tubing and form the bag of the determined width from the selected tubing;

heat seal at least a first end of the selected tubing to form one closed and sealed end thereof; and

cut the selected tubing.

20. A system for making a bag, the system comprising:

a bagmaker, the bagmaker including:

at least two roller modules for supplying and directing feeding of a plurality of widths of tubing, wherein the at least two roller modules are rotatable about a single axis, wherein each of the at least two roller modules is individually actionable via a clutch;

a motor creating a motion of one of the at least two roller modules, the selected one of the at least two roller modules being interoperable with a corresponding selected one of the plurality of widths of tubing to form a bag of a determined width from the selected tubing, the determined width corresponding to a size of an item to be contained in the bag;

a bag cutter;

a heat sealing device; and

a controller configured to selectively control operation of the bagmaker to:

feed a selective length of the selected tubing and form the bag of the determined width from the selected tubing;

cut the selected tubing; and

heat seal the selected tubing to form at least one closed and sealed end thereof.

21. A system for making a bag, the system comprising:

a bagmaker, the bagmaker including:

at least two roller modules for supplying and directing feeding of a plurality of widths of tubing, wherein the at least two roller modules are rotatable about a single axis, wherein each of the at least two roller modules is individually actionable via a clutch;

a motor creating a motion of one of the at least two roller modules, the selected one of the at least two roller modules being interoperable with a corresponding selected one of the plurality of widths of tubing to form a bag of a determined width from the selected tubing, the determined width corresponding to a size of an item to be contained in the bag;

a bag cutter;

a heat sealing device comprising, a housing, a hot bar, a compression bar, a heat sealer drive having a rotatable drive shaft, and a cam operable via the

rotatable drive shaft, wherein the compression device is selectively moveably interoperable with the hot bar via engagement of the cam with the compression device; and

a controller configured to selectively control operation of the bagmaker to:

feed a selective length of the selected tubing and form the bag of the determined width from the selected tubing;

cut the selected tubing; and

heat seal the selected tubing to form at least one closed and sealed end thereof.

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