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(54) **INTEGRATED PRODUCT FILLER**

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(51) **Int. Cl.**
B65B 1/04 (2006.01)
B65B 3/04 (2006.01)
B67C 3/02 (2006.01)

(52) **U.S. Cl.** **141/5**; 141/163; 141/255; 53/473; 222/233

(58) **Field of Classification Search** 141/1, 141/5, 129, 163, 255; 222/1, 233, 372, 380, 222/409, 410; 53/473
See application file for complete search history.

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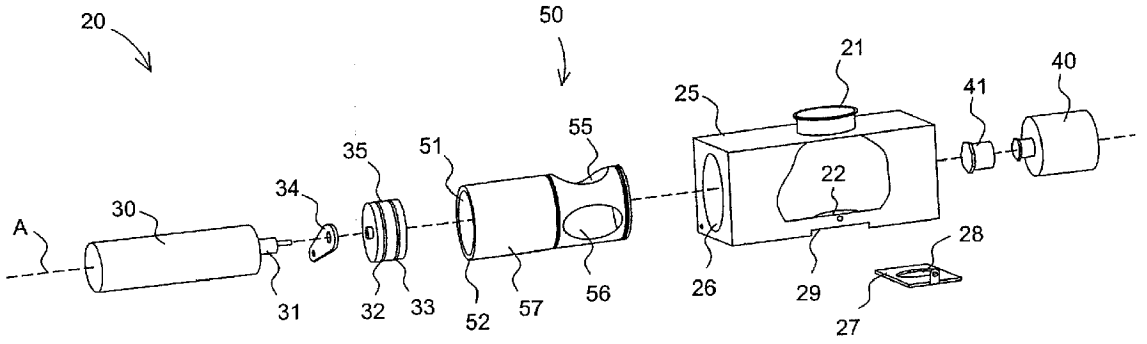
(57) **ABSTRACT**

An integrated filler system to transfer a filler product from a filler product source to a product receptacle is provided. The integrated filler system includes a cylinder housing, a pallet valve disposed within the cylinder housing that contains a product flow aperture, and a piston inserted in a valve bore of the pallet valve. A linear actuator is connected to the piston to selectively actuate a linear travel of the piston within the valve bore. A rotary actuator is connected to the pallet valve to selectively position the product flow aperture to fluidly communicate with either a product input port or a product output port formed in the cylinder housing.

23 Claims, 4 Drawing Sheets



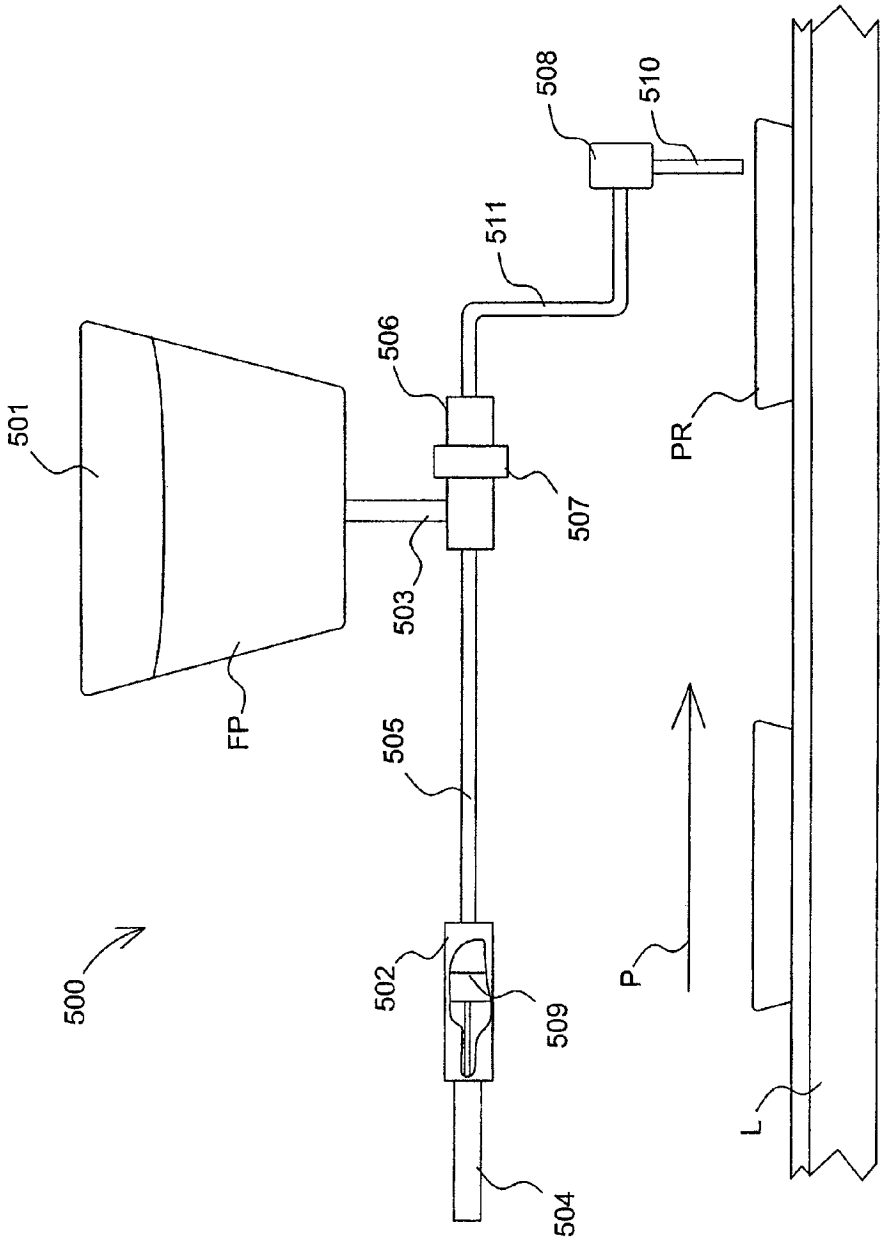
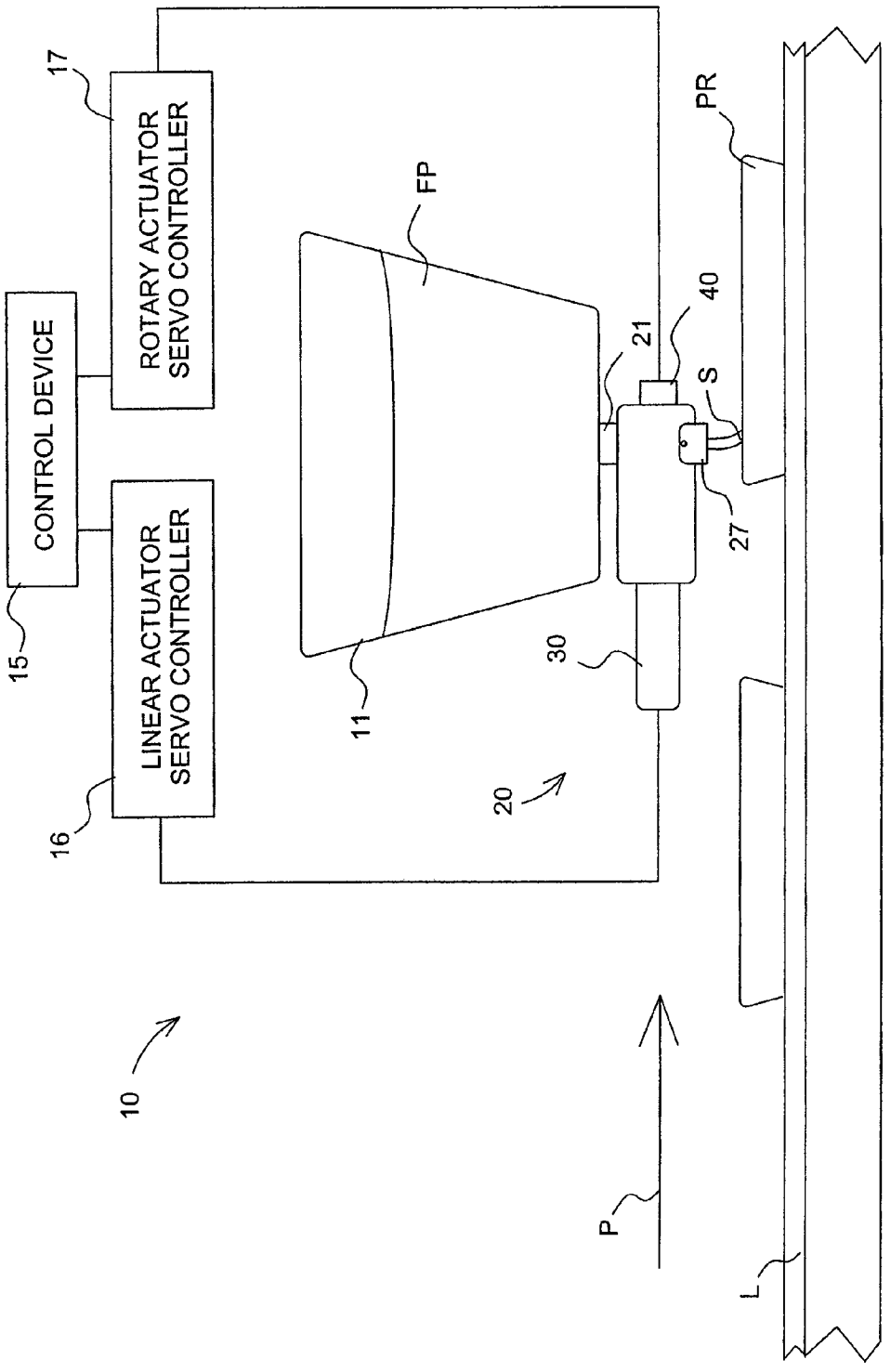


Fig. 1
(Prior Art)


17
ROTARY ACTUATOR SERVO CONTROLLER
CONTROL DEVICE
15
LINEAR ACTUATOR SERVO CONTROLLER
16
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FP
11
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21
40
S
27
30
PR
P
L

Fig. 2

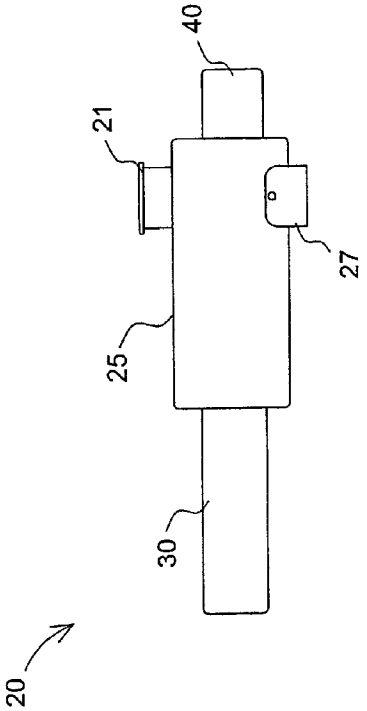
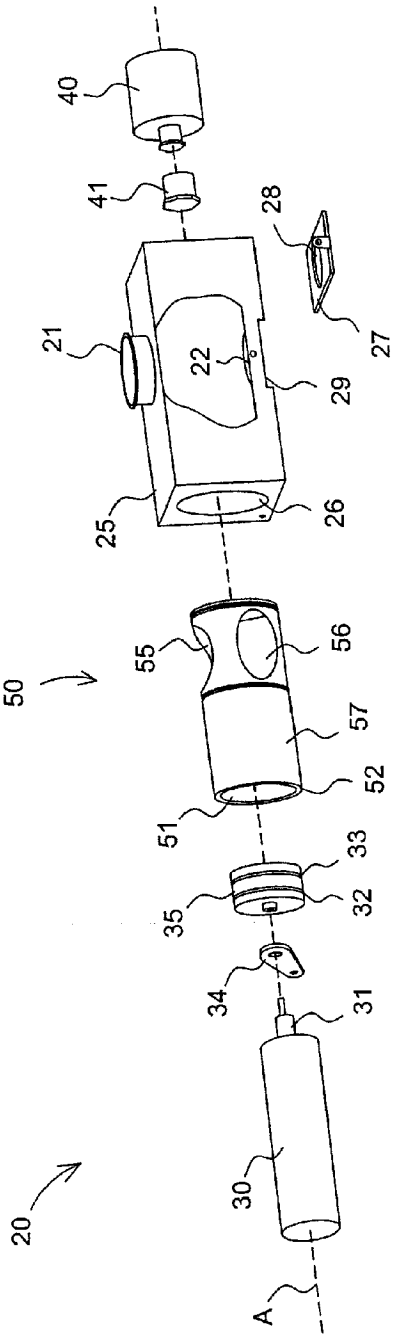

40
21
27
25
30
20

Fig. 3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20
A

Fig. 4

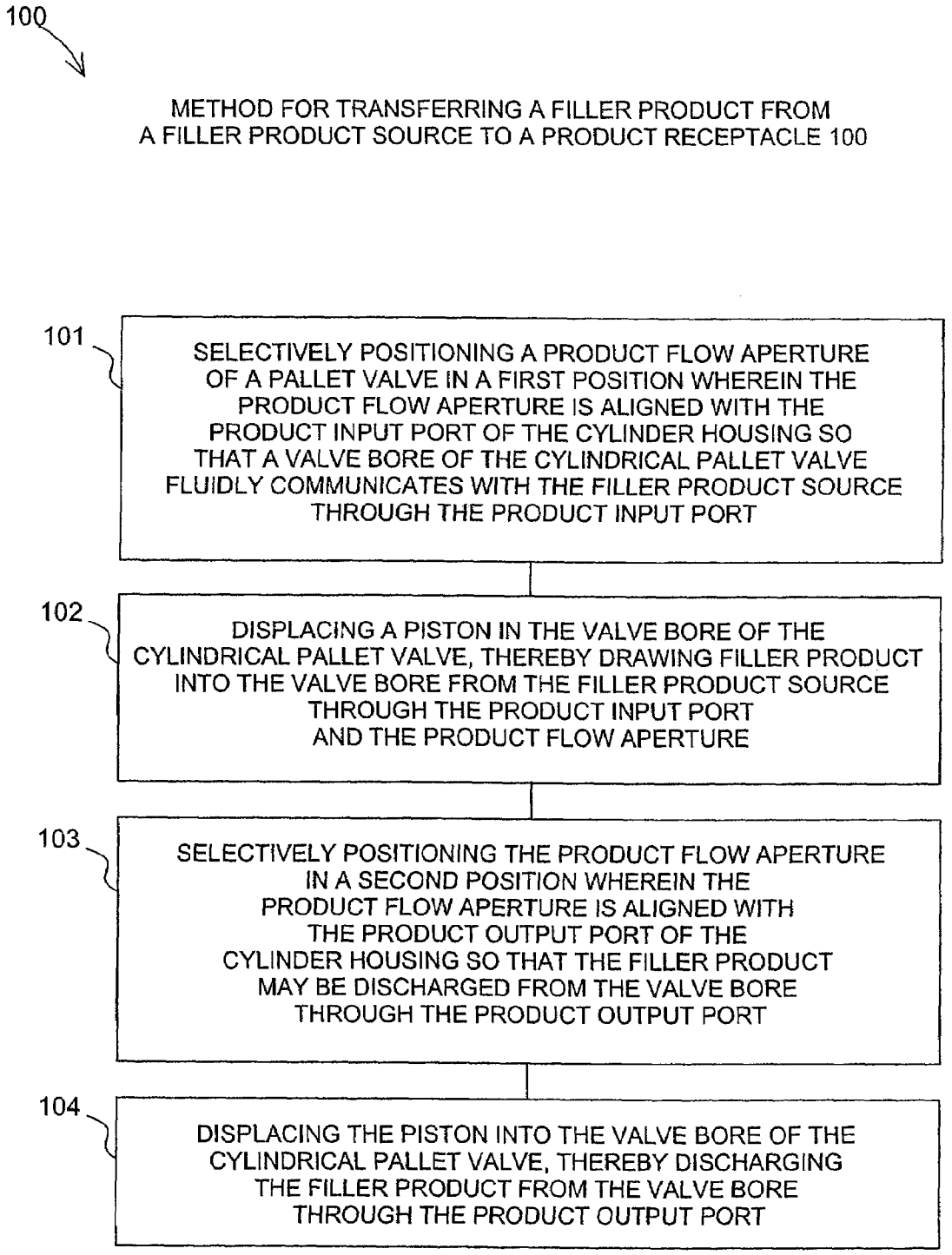
100
METHOD FOR TRANSFERRING A FILLER PRODUCT FROM A FILLER PRODUCT SOURCE TO A PRODUCT RECEPTACLE 100
101
SELECTIVELY POSITIONING A PRODUCT FLOW APERTURE OF A PALLET VALVE IN A FIRST POSITION WHEREIN THE PRODUCT FLOW APERTURE IS ALIGNED WITH THE PRODUCT INPUT PORT OF THE CYLINDER HOUSING SO THAT A VALVE BORE OF THE CYLINDRICAL PALLET VALVE FLUIDLY COMMUNICATES WITH THE FILLER PRODUCT SOURCE THROUGH THE PRODUCT INPUT PORT
102
DISPLACING A PISTON IN THE VALVE BORE OF THE CYLINDRICAL PALLET VALVE, THEREBY DRAWING FILLER PRODUCT INTO THE VALVE BORE FROM THE FILLER PRODUCT SOURCE THROUGH THE PRODUCT INPUT PORT AND THE PRODUCT FLOW APERTURE
103
SELECTIVELY POSITIONING THE PRODUCT FLOW APERTURE IN A SECOND POSITION WHEREIN THE PRODUCT FLOW APERTURE IS ALIGNED WITH THE PRODUCT OUTPUT PORT OF THE CYLINDER HOUSING SO THAT THE FILLER PRODUCT MAY BE DISCHARGED FROM THE VALVE BORE THROUGH THE PRODUCT OUTPUT PORT
104
DISPLACING THE PISTON INTO THE VALVE BORE OF THE CYLINDRICAL PALLET VALVE, THEREBY DISCHARGING THE FILLER PRODUCT FROM THE VALVE BORE THROUGH THE PRODUCT OUTPUT PORT

Fig. 5

INTEGRATED PRODUCT FILLER

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims priority to U.S. Provisional Patent Application Ser. No. 60/763,216 filed Jan. 30, 2006, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates generally to automated dispensing devices and, more particularly, to an apparatus for dispensing viscous products in production settings.

Automated fillers for dispensing viscous food product in production settings have evolved to a state wherein several devices connected in series provide the requisite functions of storage and measured dispensation of the viscous food product. In meeting these functions, conventional automated fillers often employ a viscous food product storage, a device for withdrawal of the viscous food product from the viscous food product storage, a mechanism for transferring the viscous food product from the storage device for withdrawal of the viscous food product from the viscous food product storage to a dispensing apparatus, a dispensing valve and a tube attached at one end to the dispensing valve and a second end positioned at a point of discharge.

While such conventional fillers provide for the automated dispensing of viscous food product, improvements may be realized over current designs and arrangements. For instance, given the number of discreet components or parts currently employed to accomplish the filling process, trouble shooting, adjustment and timing of the various components may be difficult and time consuming. Additionally, because the actuators of conventional fillers are often of analog design, the range and operating parameters of the fillers are typically limited.

BRIEF DESCRIPTION OF THE INVENTION

The above-mentioned limitations associated with conventional automated fillers are addressed by embodiments of the present invention and will be understood by reading and studying the following specification.

According to one aspect of the present invention, an integrated filler system to transfer a filler product from a filler product source to a product receptacle includes a cylinder housing and a pallet valve disposed within the cylinder housing, the pallet valve including a product flow aperture. The integrated filler system also includes a piston inserted in a valve bore of the pallet valve, a linear actuator connected to the piston to selectively actuate a linear travel of the piston within the valve bore. The integrated filler system further includes a rotary actuator connected to the pallet valve to selectively position the product flow aperture to fluidly communicate with one of a product input port and a product output port formed in the cylinder housing.

In accordance with another aspect of the present invention, a servo controlled integrated filler system includes a cylinder housing having a cylinder bore therein, a product input port, and a product output port. The servo controlled integrated filler system also includes a pallet valve disposed within the cylinder bore containing at least one product flow aperture therein and a piston positioned in a valve bore of the pallet valve. The servo controlled integrated filler system further includes a first actuator connected to the piston to actuate a first movement thereof, a second actuator connected to the pallet valve to selectively position the at least one product flow aperture to align with one of the product input port and the product output port, and a servo controller system to control movement of at least one of the first actuator and the second actuator.

In accordance with yet another aspect of the present invention, a method for transferring a filler product from a filler product source to a product receptacle includes the step of connecting an integrated filler system to a filler product source, the integrated filler system including a pallet valve disposed within a cylinder bore of a cylinder housing, and wherein the cylinder housing includes a product input port and a product output port selectively fluidly connected to the cylinder bore. The method also includes the steps of aligning a product flow aperture of the pallet valve with the product input port to place a valve bore in the pallet valve in fluid communication with the filler product source and displacing a piston to draw a filler product from the filler product source. The method further includes the steps of aligning the product flow aperture with the product output port; and displacing the piston to discharge the filler product through the product flow aperture and the product output port.

Additional advantages and novel features will be set forth in part in the description that follows, and in part will become apparent to those skilled in the art upon examination of the following, or may be learned by practice of embodiments of the invention. Additionally, advantages may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic representation of a conventional filler system.

FIG. **2** is a schematic representation of a filler system according to one embodiment of the present application.

FIG. **3** is a representative perspective view of an integrated filler according to one embodiment of the present application.

FIG. **4** is a representative perspective partially exploded view of an integrated filler according to one embodiment of the present application.

FIG. **5** is a schematic flow chart representing the steps of a method for transferring a filler product from a source to a receptacle.

Like reference numbers and designations in the various drawings indicate like elements.

DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific illustrative embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that logical, mechanical, and electrical changes may be made without departing from the spirit and scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense.

FIG. **1** depicts schematically a conventional filler system **500** that includes viscous food product storage **501** and product cylinder **502** including piston **509** actuated in a reciprocating fashion by actuator **504**. In operation, piston **509** can be displaced by actuator **504**, thereby withdrawing viscous food product FP from the viscous food product storage **501** through conduit **503** and pallet valve **506** into the body of

product cylinder **502**. Upon return of piston **509** by actuator **504**, viscous food product FP is forced through conduit **505** into pallet valve **506**. Pallet valve **506** includes valve position actuator **507**. Pallet valve **506** operates as a two position valve, a first position that permits viscous food product FP to pass from conduit **503**, through conduit **505** into product cylinder **502**, and a second position which permits passage of viscous food product FP from product cylinder **502** through conduits **505** and **511** to dispense valve **508**. When dispense cylinder actuator **508** and product cylinder actuator **504** are actuated, viscous food product FP is transferred through pallet valve **506** into dispense conduit **510** to be discharged as product receptacle PR passes under dispense conduit **510** on production line L. As shown, product receptacles PR proceed in a process direction P on production line L.

Referring to FIG. **2**, filler system **10** includes filler product source **11** containing filler product FP. In some embodiments, filler product FP comprises viscous food product, such as, for example, sauce, gravy, liquid, etc. In other embodiments, filler product FP comprises any suitable viscous product dispensed in a production setting. For purposes of illustration in this disclosure, filler system **10** will be described primarily with reference to a food production environment in which filler product FP comprises viscous food product.

In the embodiment illustrated in FIG. **2**, filler product source **11** is connected to integrated filler **20** at product input port **21**. As shown, filler product FP is discharged from integrated filler **20** at nozzle **27**. As product receptacle PR proceeds in process direction P on production line L, stream S of transferring filler product FP is dispensed from integrated filler **20** into product receptacle PR as it passes under nozzle **27** positioned above production line L. Linear actuator servo controller **16** is shown connected to linear actuator **30**. Linear actuator servo controller **16** is adapted to control a stroke speed and a stroke length of linear actuator **30** as discussed herein below. Rotary actuator servo controller **17** is shown connected to rotary actuator **40** and is adapted to control an angular speed and an angular displacement of the rotary actuator **40**, also discussed herein below. Control device **15** is connected to linear actuator servo controller **16** and rotary actuator servo controller **17** and is adapted for the programmable control and adjustment of linear actuator servo controller **16** and rotary actuator servo controller **17**.

In a preferred embodiment, programmable control and adjustment of linear actuator servo controller **16** and rotary actuator servo controller **17** may be accomplished in real time, permitting "on the fly" adjustment of filling parameters. In one preferred embodiment, linear actuator servo controller **16** and rotary actuator servo controller **17** comprise pneumatic servo controlled motors, such as, for example, the LS-V series linear servo controlled motors manufactured by Enfield Technologies of Trumbull, Conn., USA. Control device **15** may comprise a system controller, such as, for example, the LS-C Series Pneumatic Device Controller also manufactured by Enfield Technologies of Trumbull, Conn., USA.

Referring to FIG. **3**, one exemplary embodiment of integrated filler **20** is shown including cylinder housing **25** having product input port **21** and nozzle **27**. FIG. **3** also shows integrated filler **20** including linear actuator **30** and rotary actuator **40**.

Referring to FIG. **4**, one exemplary embodiment of integrated filler **20** is shown in a partially exploded view. Integrated filler **20** is shown including cylinder housing **25** having product input port **21** and nozzle **27**. Cylinder housing **25** is shown in a partial cutaway showing product output port **22**. Both product input port **21** and product output port **22** fluidly communicate with cylinder bore **26** of cylinder housing **25**. As seen, cylinder bore **26** is formed along longitudinal axis A. Nozzle **27** is adapted for interchangeable fit in recess **29** of cylinder housing **25**. In the illustrated embodiment, nozzle **27** includes discharge aperture **28**.

Integrated filler **20** also includes linear actuator **30** and rotary actuator **40**, as well as pallet valve **50** including a substantially cylindrical segment **52** adapted for sliding fit within cylinder bore **26**. Linear actuator **30** attaches to cylinder housing **25** employing cylinder mount **34**. Linear actuator **30** includes a selectively extendible and retractable rod **31**, which attaches to piston **35**. Piston **35** is adapted for sliding or reciprocating excursion within valve bore **51** of pallet valve **50**. In the illustrated embodiment, piston **35** includes a pair of seals **32** and **33** for providing a leak-proof sliding fit within valve bore **51** of pallet valve **50**.

Cylindrical segment **52** of pallet valve **50** is concentrically aligned with longitudinal axis A of cylinder bore **26**. Cylindrical segment **52** is further adapted for rotational movement within cylinder bore **26** about longitudinal axis A. As shown, sidewall **57** defines cylindrical segment **52** which includes valve bore **51** formed along longitudinal axis A. Pallet valve **50** includes product intake aperture **55** and product discharge aperture **56** formed through sidewall **57** of cylindrical segment **52**. In the illustrated embodiment, product intake aperture **55** is adapted for selective alignment with product input port **21** upon operation of rotary actuator **40**. Similarly, product discharge aperture **56** is adapted for selective alignment with product output port **22** upon operation of rotary actuator **40**. Rotary actuator **40** attaches to pallet valve **50** via drive shaft **41** that extends through a drive port (not shown), which is coextensive to cylinder bore **26**.

In a use environment, integrated filler **20** may take on a variety of configurations or embodiments. For instance, integrated filler **20** may be positioned in a housing or attached to peripheral or related devices or equipment. As another example, rotary actuator **40** may be configured as a direct drive or a 90° drive, and may be connected to cylindrical segment **52** employing a variety of drive configurations. Additionally, cylindrical segment **52** may include one or more product flow apertures as preferred by design or application.

FIG. **5** is a flow chart illustrating a method **100** for transferring a filler product from a filler product source to a product receptacle. In some embodiments, the method **100** employs an integrated filler system including a cylindrical pallet valve disposed within a cylinder bore of a cylinder housing, the cylinder bore including a product input port and a product output port, both selectively fluidly connected to the cylinder bore.

As shown in FIG. **5**, in a first step **101**, a product flow aperture of a pallet valve is selectively positioned in a first position wherein the product flow aperture is aligned with the product input port of the cylinder housing so that a valve bore of the cylindrical pallet valve fluidly communicates with the filler product source through the product input port. In a next step **102**, a piston is displaced in the valve bore of the cylindrical pallet valve, thereby drawing filler product into the valve bore from the filler product source through the product input port and the product flow aperture. In a step **103**, the product flow aperture is selectively positioned in a second position wherein the product flow aperture is aligned with the product output port of the cylinder housing so that the filler product may be discharged from the valve bore through the product output port. In a final step **104**, the piston is displaced into the valve bore of the cylindrical pallet valve, thereby discharging the filler product from the valve bore through the product flow aperture and the product output port.

In use, and referring again to FIGS. **2** and **4**, rotary actuator **40** initiates operation by selectively positioning cylindrical segment **52**, referring to FIG. **4**, in a first angular position by rotation along longitudinal axis A until product intake aperture **55** is aligned with product input port **21** of cylinder housing **2** so that valve bore **51** of pallet valve **50** fluidly communicates with filler product source **11**, shown in FIG. **2**, through product input port **21**. Referring to FIG. **4**, linear actuator **30** operates to displace piston **35**, thereby retracting piston **35** within valve bore **51** of pallet valve **50**. As piston **35** retracts within valve bore **51**, filler product FP, shown in FIG. **2**, is drawn into valve bore **51** from filler product source **11**, shown in FIG. **2**, through product input port **21** and product intake aperture **55**. Referring to FIG. **4**, once piston **35** has reached a selected linear position within valve bore **51**, rotary actuator **40** again initiates operation by selectively positioning cylindrical segment **52** in a second angular position by rotation along longitudinal axis A until product discharge aperture **56** aligns with product output port **22** of cylinder housing **25**. Linear actuator **30** operates to displace piston **35**, thereby pushing piston **35** into valve bore **51**. As piston **35** extends into valve bore **51**, filler product FP, shown in FIG. **2**, is discharged from valve bore **51** through product output port **22** and nozzle **27**.

The systems and methods described above present a number of distinct advantages over conventional automated fillers for dispensing viscous product. For example, by combining the structure and functionality of the product cylinder and the pallet valve, integrated filler **20** enjoys advantages in speed of operation over conventional systems. Additionally, certain conductive tubing is eliminated in such combination, resulting in increased speed of operation.

Advantages of the systems and methods described above may as well be found in the degree of control over operation parameters realized. More particularly, and referring to FIG. **2**, in some embodiments, linear actuator **30** is controlled by linear actuator servo controller **16** and rotary actuator **40** is controlled by rotary actuator servo controller **17**. Servo control of the actuators advantageously permits the ease and convenience of "on the fly" adjustment of the actuators, i.e., the actuators can be remotely adjusted during operation and the results of said adjustment may be observed in real time.

Additionally, the control device **15** permits an operator to program for a variety of flow dispensing characteristics. By way of illustration, the length of the stroke of linear actuator may be programmed for any given filler product in order to vary the amount of filler adder to any particular receptacle. Additionally, the speed of travel of the linear actuator may be varied to control the volume of flow at the nozzle. Similarly, a speed of rotation of cylindrical segment **52** and the angular position of product discharge aperture **56** may be controlled to regulate filler discharge. Additionally, various combinations of speed of linear actuator travel, speed of rotary actuator travel and configuration discharge aperture **28** of nozzle **27** may be employed to provide a wide range of selectable and programmable flow characteristics.

Therefore, according to one embodiment of the present invention, an integrated filler system to transfer a filler product from a filler product source to a product receptacle includes a cylinder housing and a pallet valve disposed within the cylinder housing, the pallet valve including a product flow aperture. The integrated filler system also includes a piston inserted in a valve bore of the pallet valve, a linear actuator connected to the piston to selectively actuate a linear travel of the piston within the valve bore. The integrated filler system further includes a rotary actuator connected to the pallet valve to selectively position the product flow aperture to fluidly communicate with one of a product input port and a product output port formed in the cylinder housing.

In accordance with another embodiment of the present invention, a servo controlled integrated filler system includes a cylinder housing having a cylinder bore therein, a product input port, and a product output port. The servo controlled integrated filler system also includes a pallet valve disposed within the cylinder bore containing at least one product flow aperture therein and a piston positioned in a valve bore of the pallet valve. The servo controlled integrated filler system further includes a first actuator connected to the piston to actuate a first movement thereof, a second actuator connected to the pallet valve to selectively position the at least one product flow aperture to align with one of the product input port and the product output port, and a servo controller system to control movement of at least one of the first actuator and the second actuator.

In accordance with yet another embodiment of the present invention, a method for transferring a filler product from a filler product source to a product receptacle includes the step of connecting an integrated filler system to a filler product source, the integrated filler system including a pallet valve disposed within a cylinder bore of a cylinder housing, and wherein the cylinder housing includes a product input port and a product output port selectively fluidly connected to the cylinder bore. The method also includes the steps of aligning a product flow aperture of the pallet valve with the product input port to place a valve bore in the pallet valve in fluid communication with the filler product source and displacing a piston to draw a filler product from the filler product source. The method further includes the steps of aligning the product flow aperture with the product output port; and displacing the piston to discharge the filler product through the product flow aperture and the product output port.

Although this invention has been described in terms of certain preferred embodiments, other embodiments that are apparent to those of ordinary skill in the art, including embodiments that do not provide all of the features and advantages set forth herein, are also within the scope of this invention. Accordingly, the scope of the present invention is defined only by reference to the appended claims and equivalents thereof.

What is claimed is:

1. An integrated filler system to transfer a filler product from a filler product source to a product receptacle, the integrated filler system comprising:

a cylinder housing having a cylinder bore therein, a product input port and a product output port;

a pallet valve disposed within the cylinder housing, the pallet valve including a product flow aperture;

a piston inserted in a valve bore of the pallet valve;

a linear actuator connected to the piston to selectively actuate a linear travel of the piston within the valve bore; and

a rotary actuator connected to the pallet valve to selectively position the product flow aperture to fluidly communicate with one of the product input port and the product output port formed in the cylinder housing.

2. The integrated filler system of claim **1** further comprising a linear actuator servo controller to control at least one of a stroke length and a stroke speed of the linear actuator.

3. The integrated filler system of claim **2** further comprising a rotary actuator servo controller to control at least one of an angular speed and an angular displacement of the rotary actuator.

4. The integrated filler system of claim 3 further comprising a control device connected to the linear actuator servo controller and the rotary actuator servo controller to control operation thereof in real-time.

5. The integrated filler system of claim 1 wherein when the product flow aperture is in fluid communication with the product input port, a filler product is transferred from a filler product source into the valve bore.

6. The integrated filler system of claim 1 wherein when the product flow aperture is in fluid communication with the product output port, a filler product is transferred out from the valve bore.

7. The integrated filler system of claim 1 wherein the linear actuator further comprises an actuator rod configured to selectively extend and retract to move the piston.

8. The integrated filler system of claim 1 wherein the rotary actuator is one of an in-line direct drive and a 90° drive.

9. The integrated filler system of claim 1 wherein the piston further comprises at least one seal to form a leak-proof fit between the piston and the pallet valve.

10. The integrated filler system of claim 1 further comprising a driveshaft to connect the rotary actuator to the pallet valve.

11. A servo controlled integrated filler system comprising:

a cylinder housing having a cylinder bore therein, a product input port, and a product output port;

a pallet valve disposed within the cylinder bore containing at least one product flow aperture therein;

a piston positioned in a valve bore of the pallet valve;

a first actuator connected to the piston to actuate a first movement thereof;

a second actuator connected to the pallet valve to selectively position the at least one product flow aperture to align with one of the product input port and the product output port; and

a servo controller system to control movement of at least one of the first actuator and the second actuator.

12. The servo controlled integrated filler system of claim 11 wherein the servo controller system further comprises a control device to programmably control and adjust operation of the servo controller system.

13. The servo controlled integrated filler system of claim 11 wherein the servo controller system further comprises a first actuator servo controller connected to the control device and the first actuator and configured to control a speed of the first actuator.

14. The servo controlled integrated filler system of claim 11 wherein the servo controller system further comprises a second actuator servo controller connected to the second actuator and configured to control a speed of the second actuator.

15. The servo controlled integrated filler system of claim 11 wherein the at least one product flow aperture further comprises an intake aperture and a discharge aperture.

16. The servo controlled integrated filler system of claim 15 wherein the intake aperture selectively fluidly communicates with the product input port and the discharge aperture selectively fluidly communicates with the product output port.

17. The servo controlled integrated filler system of claim 11 wherein the first actuator is a linear actuator having an adjustable stroke length and stroke speed and the second actuator is a rotary actuator having an adjustable angular displacement and angular speed.

18. A method for transferring a filler product from a filler product source to a product receptacle comprising the steps of:

connecting an integrated filler system to a filler product source, the integrated filler system including a pallet valve disposed within a cylinder bore of a cylinder housing a piston inserted in a valve bore of the pallet valve, wherein the cylinder housing includes a product input port and a product output port selectively fluidly connected to the cylinder bore;

aligning a product flow aperture of the pallet valve with the product input port to place a valve bore in the pallet valve in fluid communication with the filler product source;

displacing a piston to draw the filler product from the filler product source;

aligning the product flow aperture with the product output port; and

displacing the piston to discharge the filler product through the product flow aperture and the product output port.

19. The method of claim 18 wherein displacing the piston further comprises moving the piston into and out from the valve bore of the pallet valve.

20. The method of claim 19 wherein displacing the piston further comprises actuating a linear actuator to linearly displace the piston within the valve bore.

21. The method of claim 18 wherein aligning the product flow aperture further comprises actuating a rotary actuator connected to the pallet valve to rotate the product flow aperture.

22. The method of claim 18 further comprising discharging the filler product from a nozzle attached to the product output port and into a product receptacle.

23. The method of claim 18 further comprising adjusting the displacing of the piston and alignment of the product flow aperture by way of a servo control system.

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