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(54) **TRANSPORTER DEVICE**

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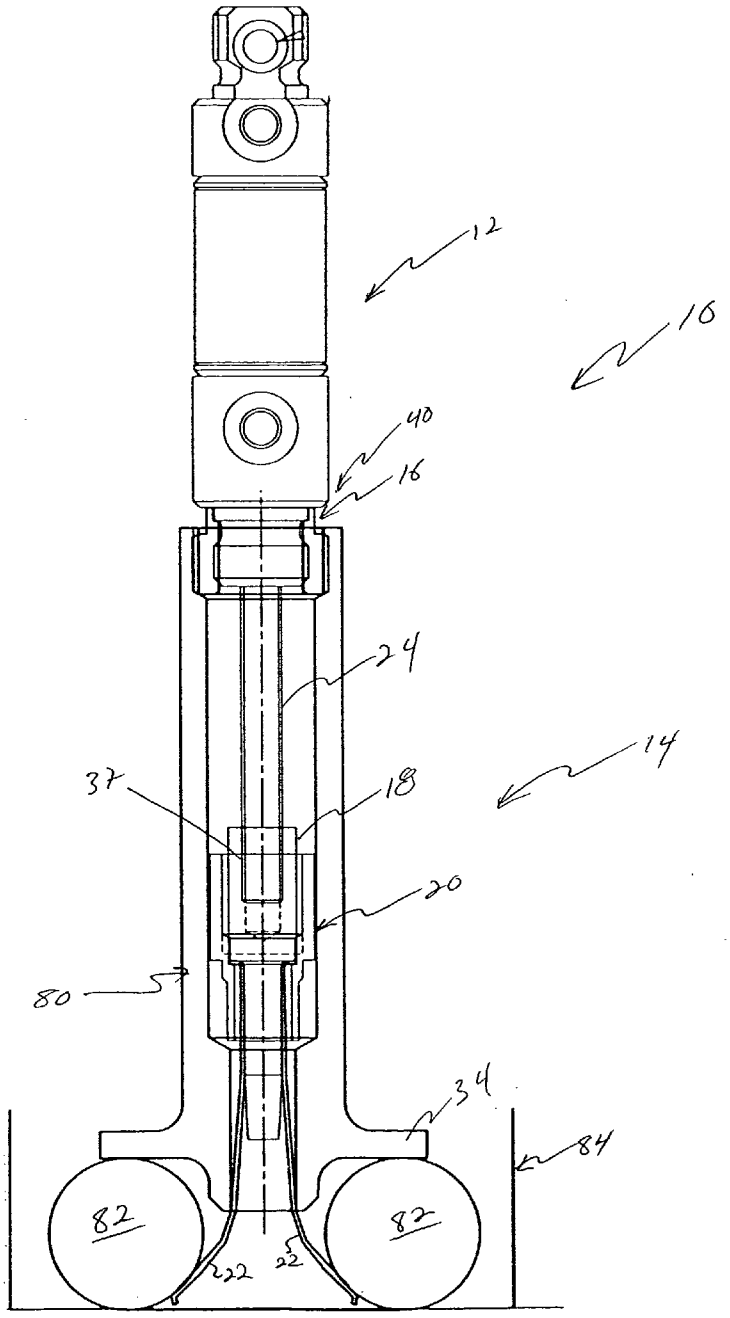
(57) **ABSTRACT**

A transport device is provided comprising an actuator, a body coupled to the actuator, and a plurality of arms.



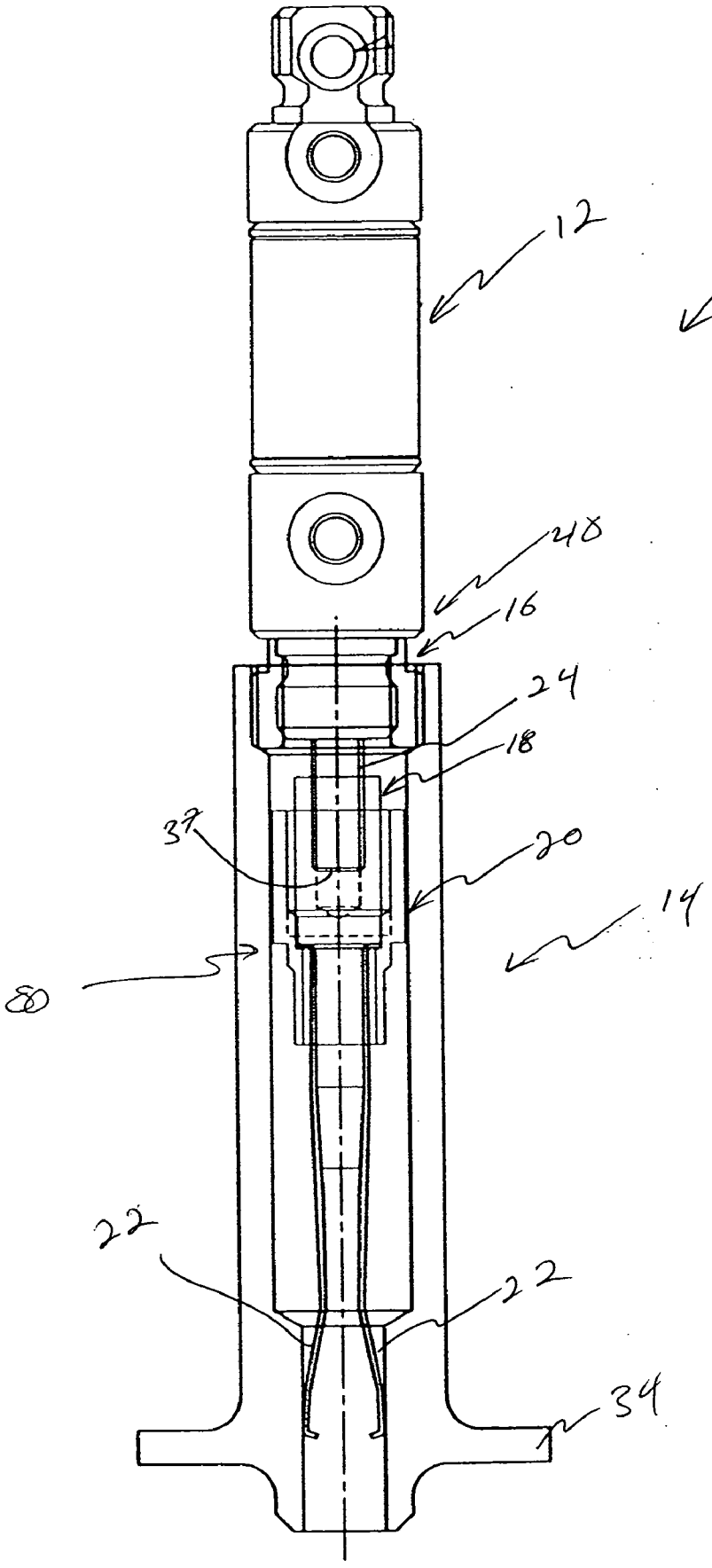


Fig. 1

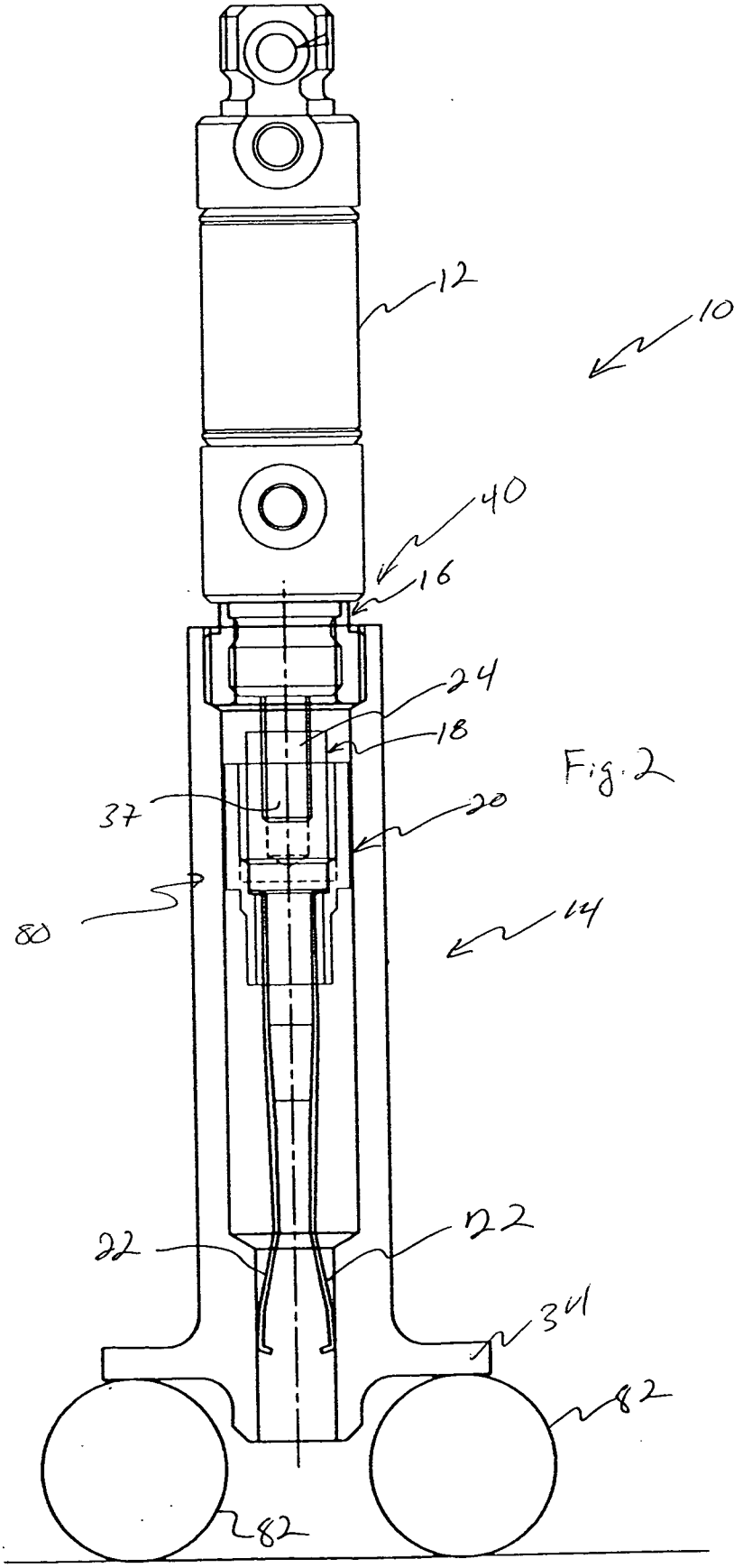


Fig. 2

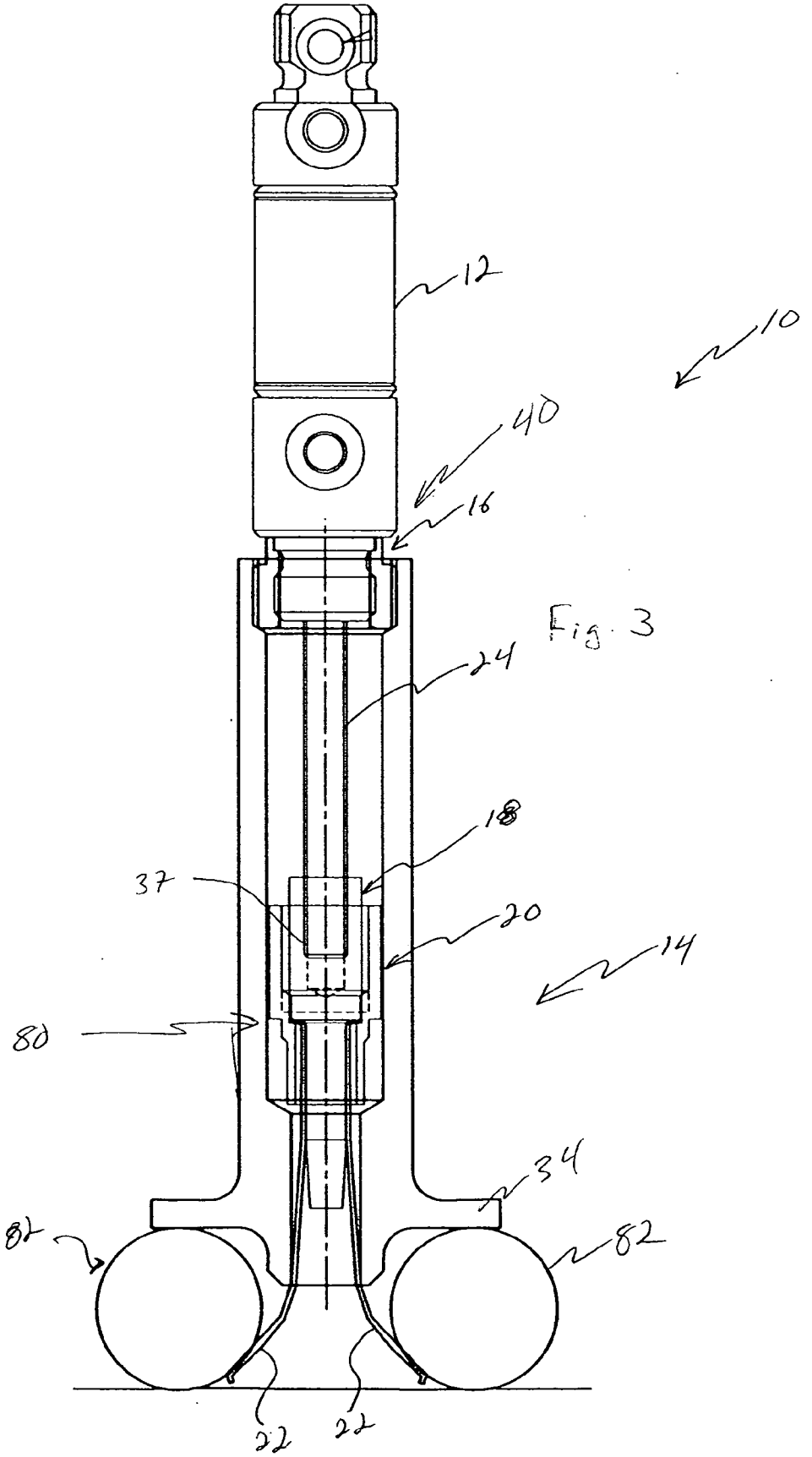


Fig. 3

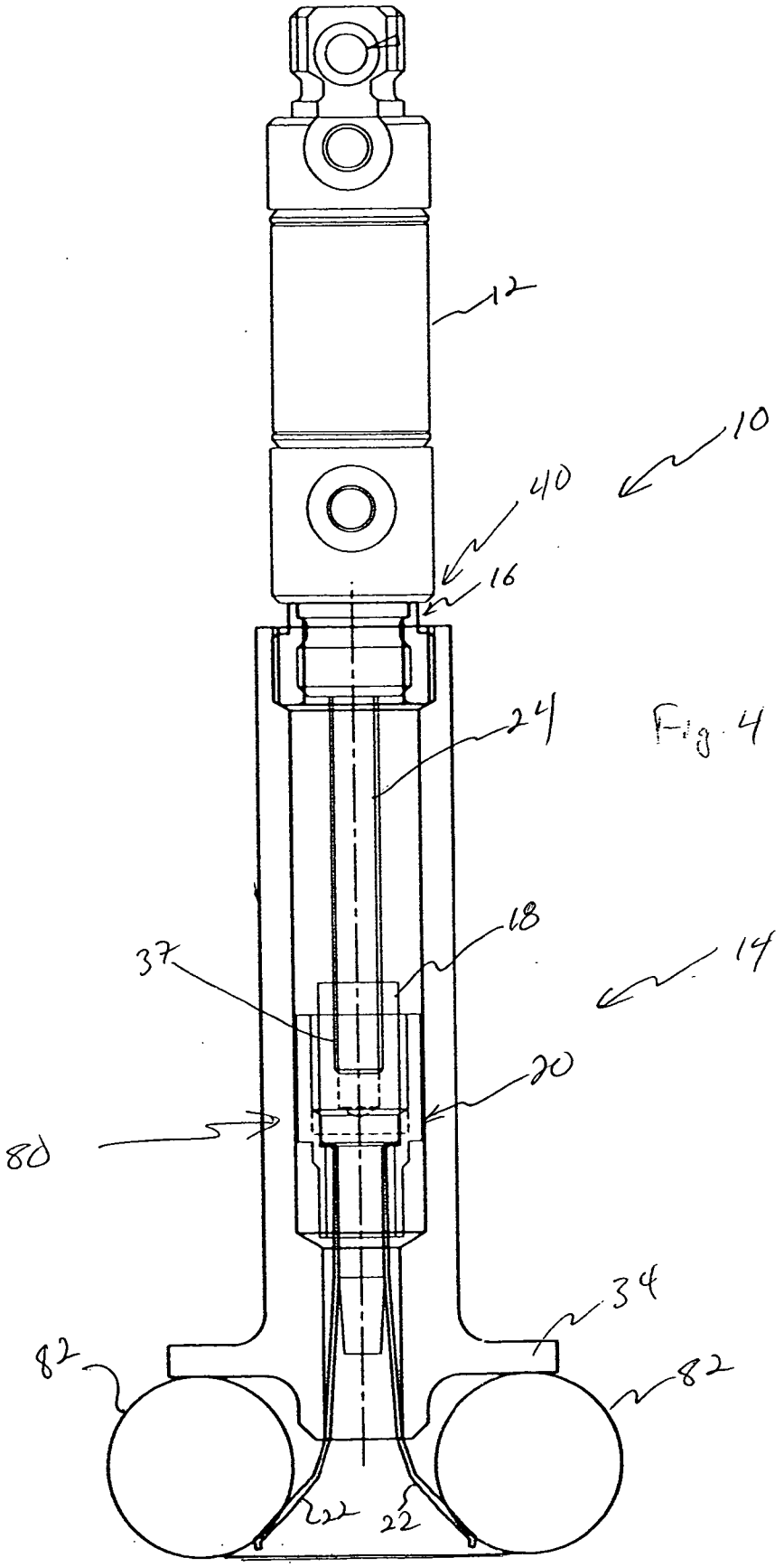


Fig. 4

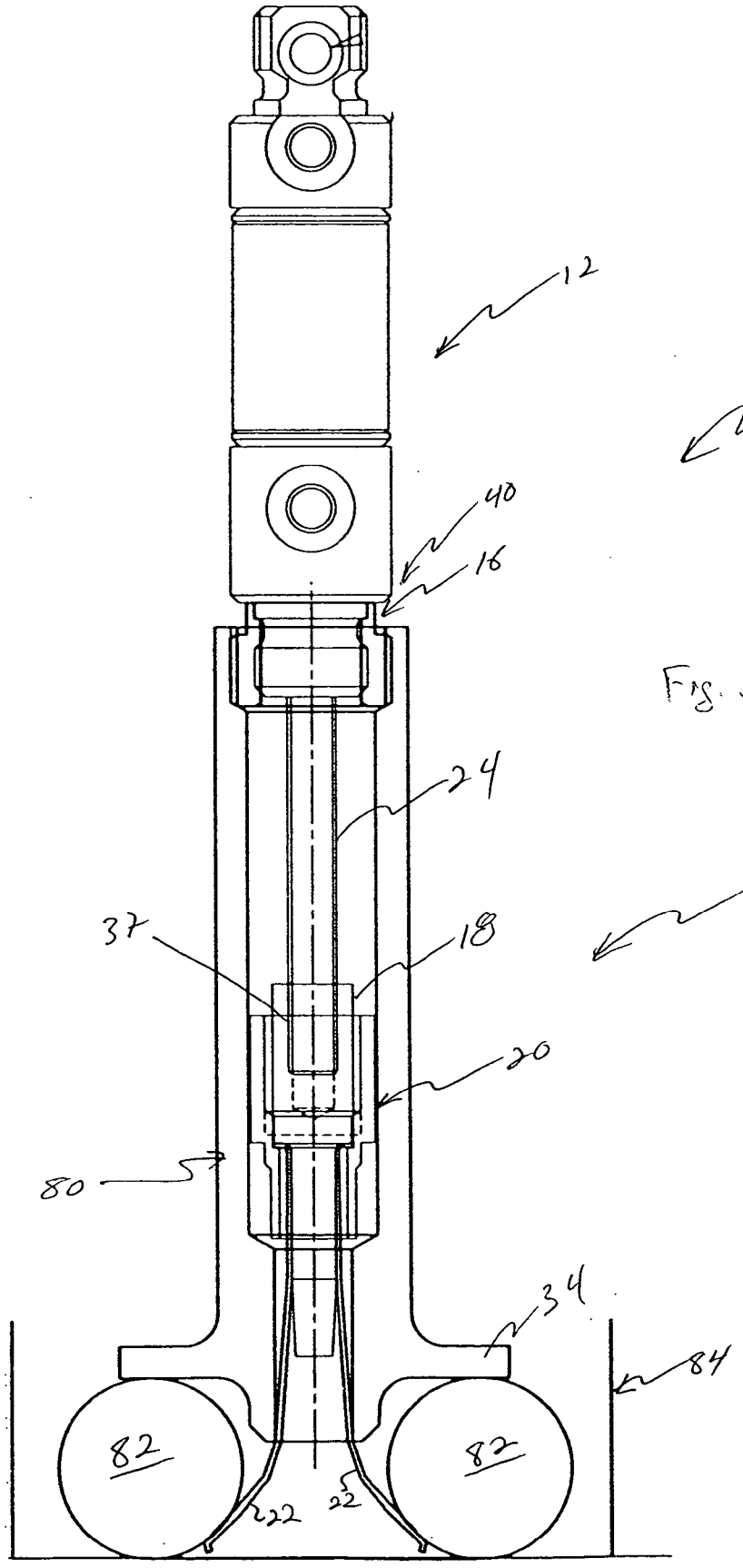


Fig. 5

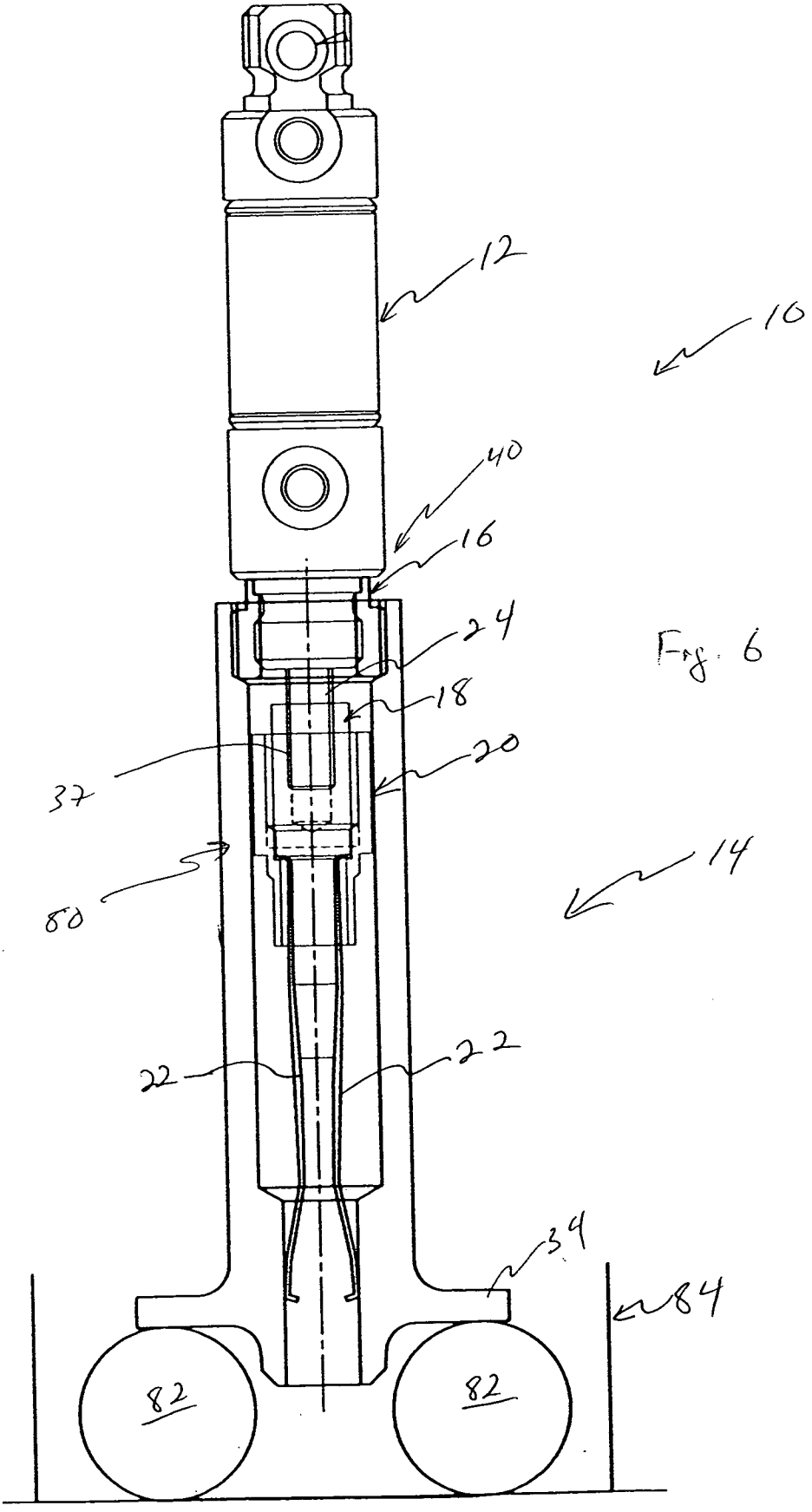


Fig. 6

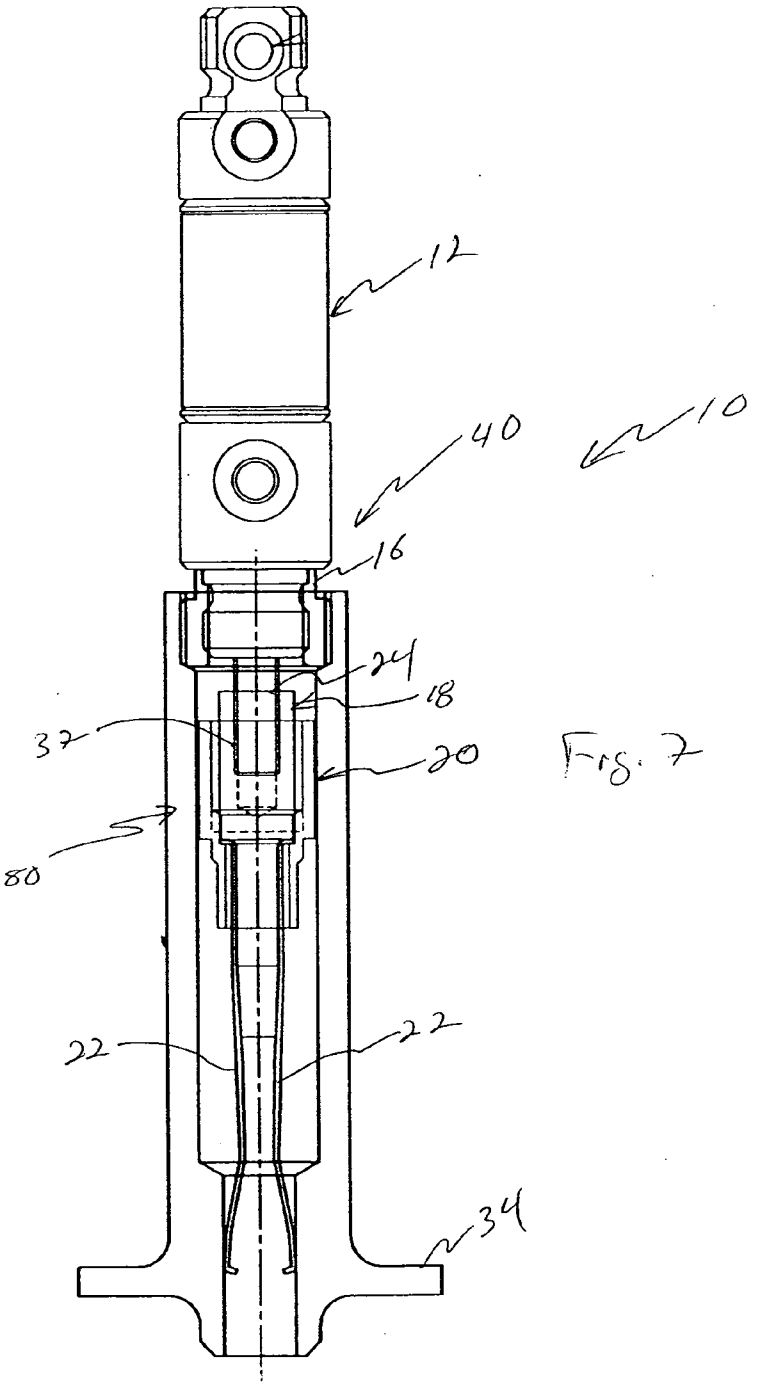


Fig. 7

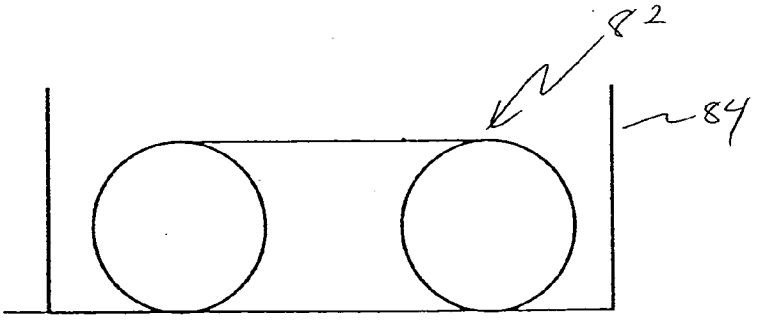
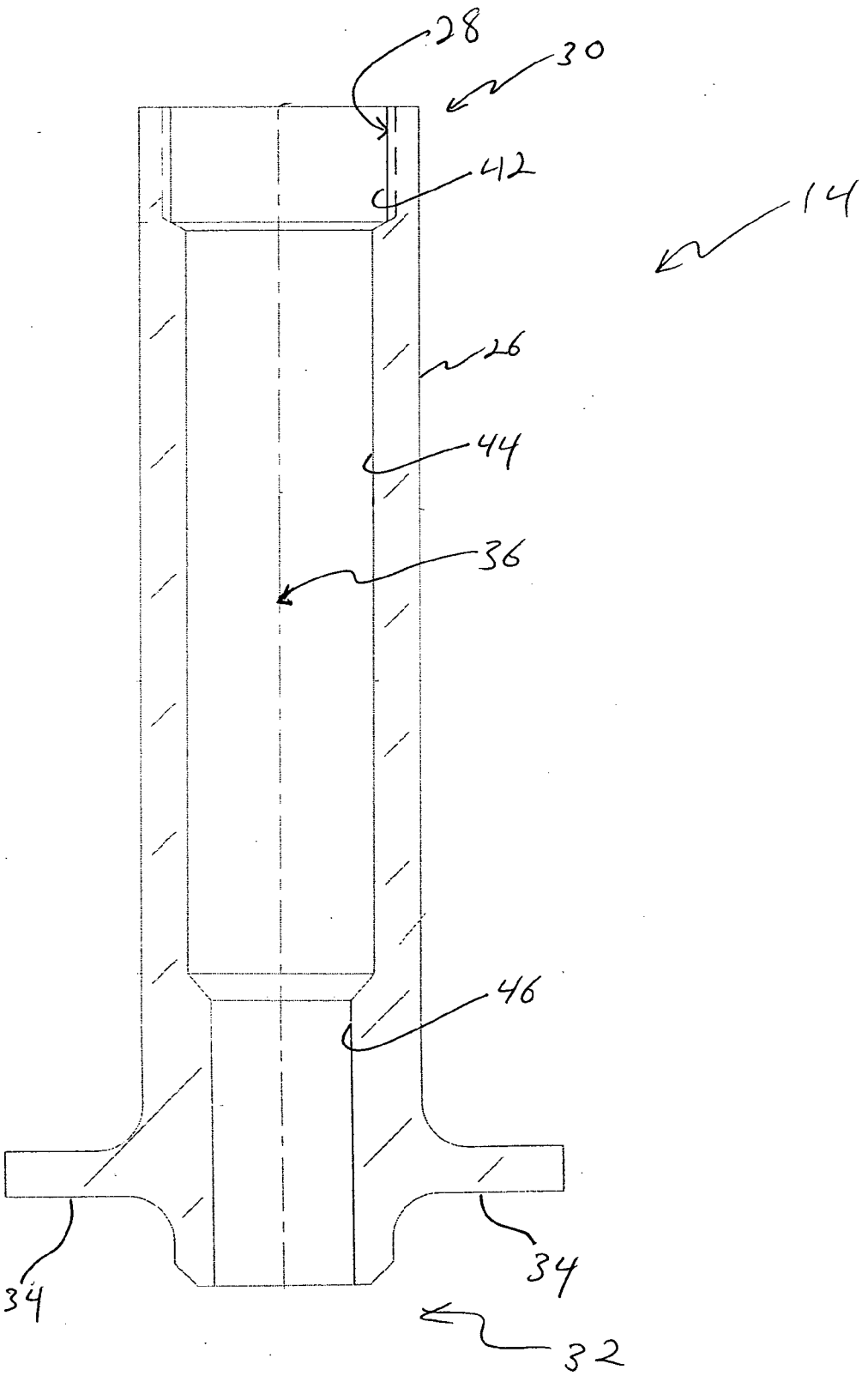


Fig. 8



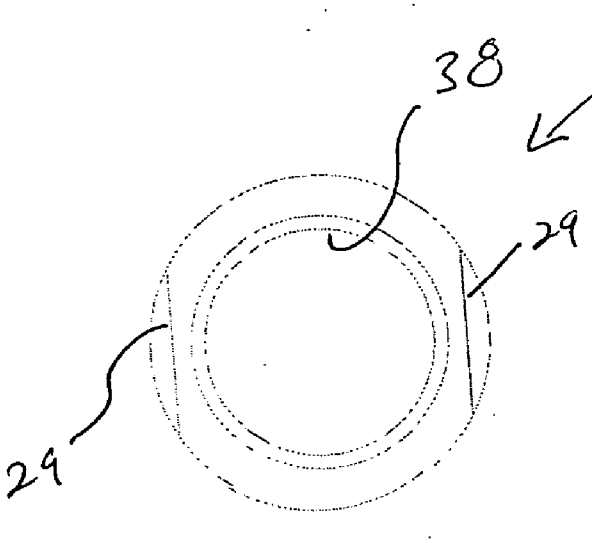


Fig. 9b

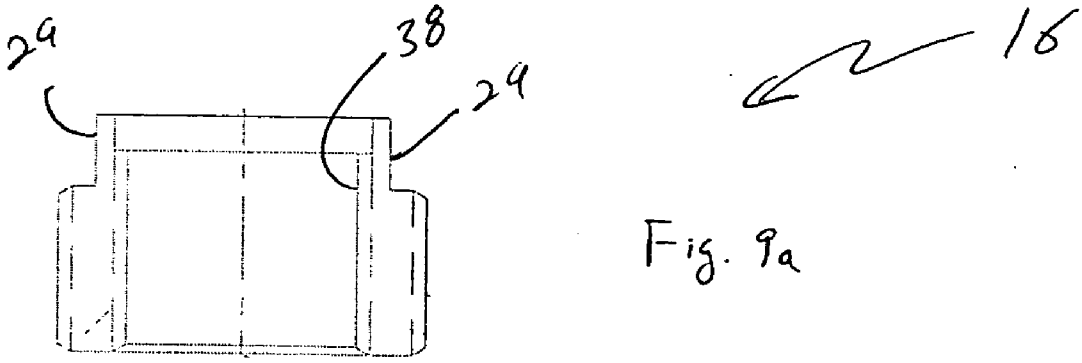


Fig. 9a

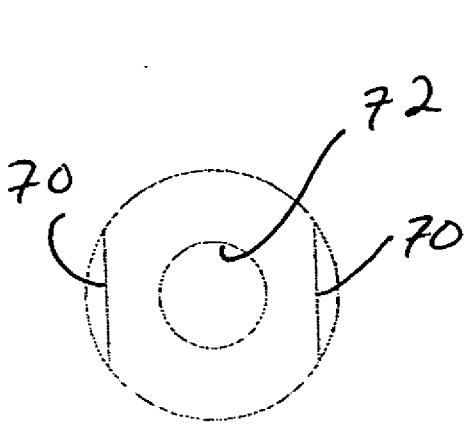


Fig 10b

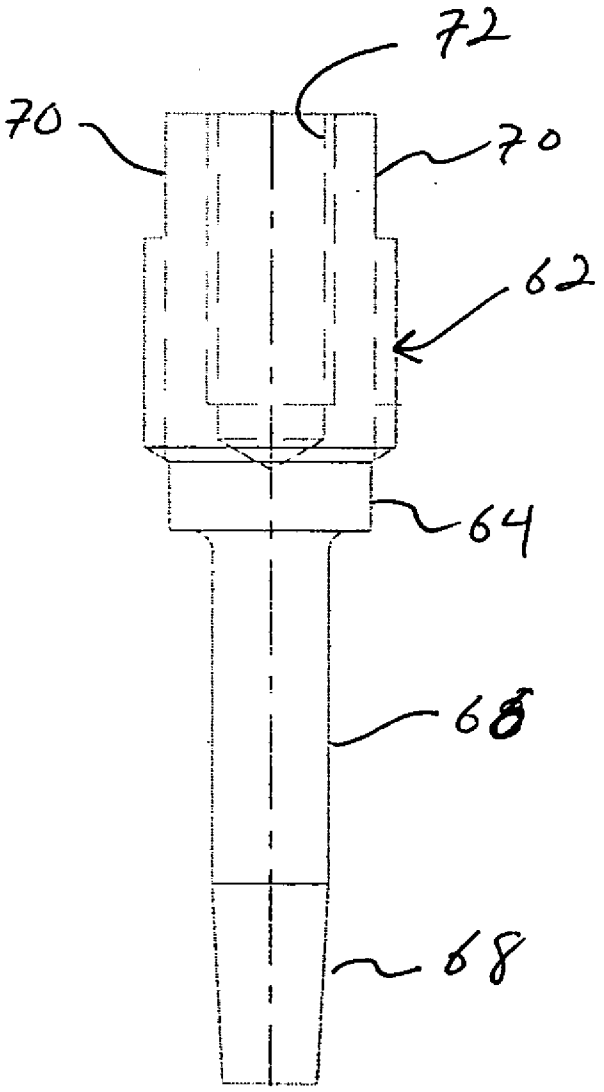


Fig. 10a

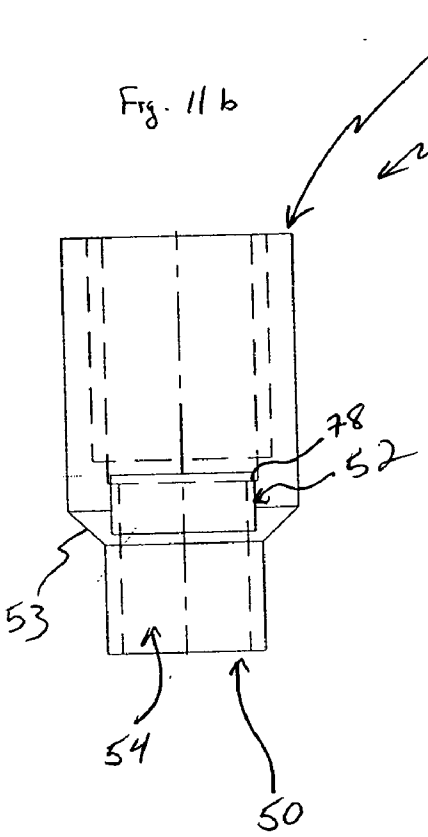


Fig. 11b

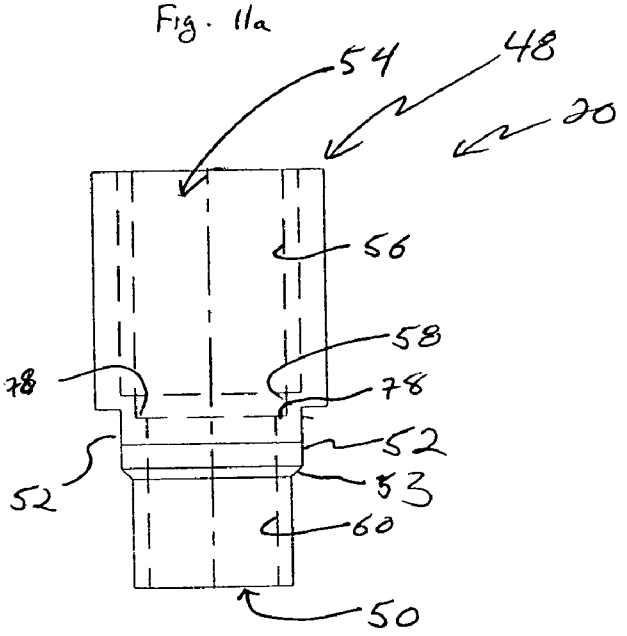


Fig. 11a

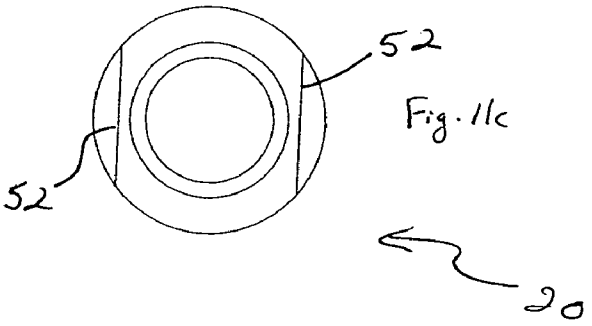
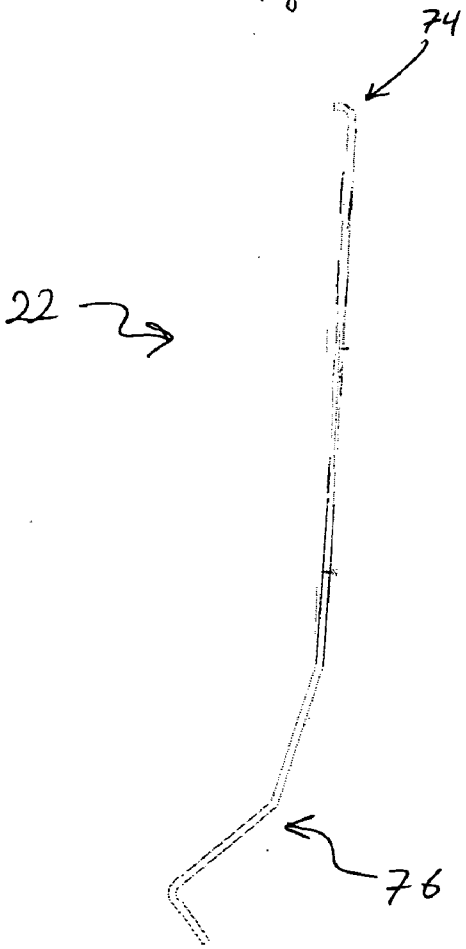


Fig. 11c

Fig. 12b

Fig. 12a

Fig. 12c



TRANSPORTER DEVICE

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The present invention relates to transporters, such as conveyor systems, and in particular to gripper transporters used in the food industry.

[0002] Many types of products are transported by transporters, such as conveyor systems. For instance, in the food industry prepared food items, such as pizzas, entrees, and desserts, are assembled from various component pieces, including foodstuffs and packaging, which are transported by one or more transporters. Furthermore, the finished product and/or the component pieces are often transported on or by transporters between processing stations such as a packaging station.

[0003] The creation of the finished product from the component pieces often requires that the component pieces be brought together at certain times. Furthermore, such transport must be tailored to the piece being transported.

[0004] In one exemplary embodiment, a transport device is provided comprising an actuator a body coupled to the actuator having an abutment surface, and a plurality of arms coupled to the actuator that selectively extend from and retract into the body. The arms are spring loaded when within the body, and the arms provide a support surface for an item when extended outside the body.

[0005] An another embodiment, a method of transporting an item is provided including the steps of providing a transporter including an actuator; abutting the item with the transporter; activating the actuator to couple the transporter to the item; moving the transporter and the item coupled thereto; de-activating the actuator to uncouple the transporter from the item; and disengaging the transporter from the item.

[0006] In yet another embodiment of the present invention, a method of providing sanitary transport of a donut is provided including the steps of providing a transporter including an annular surface, abutting a top surface of the donut with the annular surface of the transporter, extending at least one arm from a position within the transporter to a position external to the transporter such that the at least one arm contacts the donut and hold the donut in contact with the annular surface, moving the transporter and donut about a facility, retracting the at least one arm from the external position to the internal position to release the donut from the transporter, and moving the transporter to disengage the transporter from the donut.

[0007] In another embodiment of the present invention, a transport device is provided comprising, an actuator, a body coupled to the actuator having an abutment surface, and a plurality of arms coupled to the actuator that selectively extend from and retract into the body. Extension of the arms from the body provides for grasping of an item between the arms and the abutment surface.

[0008] Additional features of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** is a side elevation view of an exemplary transporter with portions cut away;

[0010] **FIG. 2** is a side elevation view of the transporter of **FIG. 1** preparing to engage a foodstuff with portions cut away;

[0011] **FIG. 3** is a side elevation view of the transporter of **FIG. 1** engaging the foodstuff with portions cut away;

[0012] **FIG. 4** is a side elevation view of the transporter of **FIG. 1** transporting the foodstuff with portions cut away;

[0013] **FIG. 5** is a side elevation view of the transporter of **FIG. 1** placing the foodstuffs in packaging with portions cut away;

[0014] **FIG. 6** is a side elevation view of the transporter of **FIG. 1** releasing the foodstuffs with portions cut away;

[0015] **FIG. 7** is a side elevation view of the transport system of **FIG. 1** retreating from the foodstuff with portions cut away;

[0016] **FIG. 8** is a cross sectional view of a gripper shell of the system of **FIG. 1**;

[0017] **FIGS. 9***a* & *b* are a cross sectional and top views, respectively, of a shell adapter of the system of **FIG. 1**;

[0018] **FIGS. 10***a* & *b* are cross sectional and top views, respectively, of a piston attachment **18** of the system of **FIG. 1**;

[0019] **FIGS. 11***a, b*, & *c* are cross sectional, cross sectional side, and bottom views, respectively, of an arm coupler of the system of **FIG. 1**; and

[0020] **FIGS. 12***a, b*, & *c* are front flat, side flat, and side shaped views of an arm of the system of **FIG. 1**.

DETAILED DESCRIPTION OF THE DRAWINGS

[0021] In automated or semi-automated assembly systems, a number of transporters and conveyors are typically present. The transporters and conveyors provide consistency of part placement and process repeatability. Thus, a particular transporter is programmed to know where to go to retrieve a certain piece and knows to move the piece to a second location where it may be processed or otherwise subjected to another transporter. Such a system is described in U.S. patent application Ser. No. 10/678,708 titled A Transport System assigned to Raque Food Systems, Inc. that is expressly incorporated herein.

[0022] A transporter **10** is described herein that provides a gripping strength sufficient to grab and hold a baked product, such as a donut, but not crush the product during the gripping. Accordingly, transporter **10** includes a cylinder **12** and shell **14** coupled to cylinder **12** by adapter **16**. Transporter **10** further includes piston attachment **18** that couples a piston **24** of cylinder **12** to at least two, preferably four, arms **22** via arm coupler **20**.

[0023] Cylinder **12** is preferably a pneumatic cylinder having a piston **24** therein. Cylinder **12** has one or more air supply lines (not pictured) coupled thereto. Cylinder **12** is also coupled to an arm (not pictured) that provides for movement of the cylinder **12** vertically and horizontally about a facility. The arm is preferably a mechanical arm that is computer controlled. First end **40** of cylinder **12** includes a threaded portion to engage adapter **16**. Piston **24** is movable relative to cylinder **12** so as to have a retracted

position (**FIGS. 1, 2, 6, 7**) and an extended position (**FIGS. 3-5**). End **37** of piston **24** is threaded to engage piston attachment **18**.

[**0024**] Adapter **16**, shown in **FIGS. 9***a*, **9***b*, is an annular structure having a threaded bore **38** defined therein sized and shaped to threadably receive first end **40** of cylinder **12** therein. An outer diameter of adapter **16** is threaded, sized, and shaped to be threadably received in a first section **42** of a multi-diametered bore **28** defined within shell **14**. The outside of adapter **16** also includes wrench flats **29** to assist in theadably engaging adapter **16** to shell **14** and to cylinder **12**.

[**0025**] Shell **14**, shown in **FIG. 8**, is a substantially cylindrical body **26** having multi-diametered bore/aperture **28** therein. Body **26** includes a proximal end **30** and a distal end **32**. Distal end **32** includes a contact surface **34**. Contact surface **34** is annular and circumscribes body **26**. Also, contact surface **34** extends perpendicularly to a longitudinal axis **36** of transporter **10**. Embodiments are envisioned having a non-annular contact surface **34** where one or more contact surfaces **34** extend from body **26** to correlate to arms **22**. The portion of body **26** below contact surface **34** has an outer diameter that is small enough to fit within the "hole" of a donut **82** or within a cavity of the item to be transported.

[**0026**] Bore **28** includes three sections **42, 44, 46**. First section **42** is at proximal end **30** and is the largest of the three sections **42, 44, 46**. As previously described, first section **42** is threaded, sized, and shaped to threadably receive adapter **16** therein. The diameter of second section **44** is smaller than the diameter of first section **42** but larger than the diameter of third section **46**. The diameter of second section **44** is sized to slidably receive arm coupler **20** therein.

[**0027**] Arm coupler **20**, shown in **FIGS. 11***a, b, & c*, is an annular member having a first end **48** and a second end **50**. First end **48** has an outer diameter slightly smaller than the diameter of second section **44** of bore **28** of shell **14**. Second end **50** has a diameter slightly smaller than third section **46** of bore **28** of shell **14**. In between first end **48** and second end **50** is a transition portion **53** that tapers on some sides (see **FIGS. 11***b* & *c*) and includes wrench flats **52** on other sides (see **FIGS. 11***a* & *c*). Internally, arm coupler **20** includes bore **54** therein. Bore **54** includes three sections **56, 58, 60** decreasing in diameter from first end **48** to second end **50**. First section **56** is threaded and of a diameter slightly larger than a first section **62** of piston attachment **18**. Second section **58** is of a diameter slightly larger than a second section **64** of piston attachment **18**. Third section **60** is of a diameter slightly larger than a third section **66** of piston attachment **18**. Accordingly, piston attachment **18** is sized and shaped to be received in bore **54** of arm coupler **20**. A shoulder **78** is provided between second and third sections **58, 60**.

[**0028**] Piston attachment **18** shown in **FIGS. 10** *a* & *b* is a substantially cylindrical, multi-diametered, body. Piston attachment **18** includes first, second, third, and fourth sections **62, 64, 66, 68**. First section **62** includes external wrench flats **70** and an internal piston bore **72**. Wrench flats **70** extend only part of the length of first section **62** and provide parallel surfaces on opposite sides of piston attachment **18** suitable for being engaged by a wrench. The balance of the external of first section **62** not covered by wrench flats **70** is threaded to engage first section **56** of bore **54** of arm coupler **20**. Piston bore **72** is also threaded to engage end **37** of piston **24**. Second section **64** is sized and shaped to have a slightly smaller diameter than second section **58** of arm coupler **20**. Third section **66** is of a diameter slightly less than third section **60** of arm coupler **20**. Finally, fourth section **68** is of a decreasing diameter as the distance from third section **66** increases.

[**0029**] Arms **22** are originally flat thin metal pieces as shown in **FIGS. 12** *a* & *b* that are bent to provide an attachment bend **74** and a grasp curl **76** as shown in **FIG. 12***c*. When assembled, arms **22** are placed within third section **60** of bore **54** of arm coupler **20** such that attachment bends **74** of respective arms **22** sit on shoulder **78**. Arms are preferably evenly distributed around sides of bore **54** of arm coupler **20**. Once so seated, piston attachment **18** is threadably engaged to arm coupler **20** to hold arms **22** in place to create an arm assembly **80**. The bent resting state of arms **22** causes arms **22** to act similarly to springs. Thus, the deflection of arms **22** is a function of the spring constant and the force applied.

[**0030**] In assembly, bore **38** of adapter **16** threadably couples to first end **40** of cylinder **12**. Then, piston bore **72** of piston attachment **18** of arm assembly **80** threadably couples to piston **24**. Shell **14** is placed over arm assembly **80** to receive arm assembly **80** within bore **28**. Finally, first section **42** of bore **28** is threadably coupled to adapter **16**, and thus cylinder **12**.

[**0031**] In use, piston **24** and arm assembly **80** selectively assume first positions and second positions. First position of piston **24** and assembly **80** is a retracted position shown in **FIGS. 1, 2, 6**, and **7**. In first position, arm coupler **20** is spaced apart from third section **46** of bore **28** of shell **14**. Grasp curls **72** of arms **22** are withdrawn into third section **46** of bore **28** of shell **14** and contracted. Second position of piston **24** and assembly **80** is an extended position shown in **FIGS. 3-5**. In the second position, arm coupler **20** is proximate, but not within, third section **46** of bore **28** of gripper shell **28**. The second position allows grasp curls **72** of arms to extend down and out of bore **28** and to expand. Such extension allows arms **22** to be relatively unrestrained and assume a curled attitude for engaging donut **82** through the donut "hole" and supporting donut **82** from beneath.

[**0032**] **FIGS. 1-7** show transporter **10** in various stages of transporting items such as a donut **82**. **FIG. 1** shows transporter **10** ready to approach donut **82**. Transporter **10** is in a raised position with piston **24** in the first, retracted, position. **FIG. 2** shows transporter **10** in a lowered position with piston **24** still retracted. Transporter **10** is lowered such that contact surfaces **34** abut donut **82**. **FIG. 3** shows piston **24** having moved to the second, extended, position. Placing piston **24** in the second position causes arms **22** to extend out of bore **28** and assume curved attitudes. The curved attitudes along with the positioning of transporter **10** proximate donut **82** causes grasp curls **76** of arms **22** to engage donut **82**. Furthermore, grasp curls **76** secure donuts **82** between arms **22** and contact surface **34**. **FIG. 4** shows transporter **10** in the raised position with donut **82** coupled thereto. Transporter **10** then moves about a facility, such as a packaging facility, and aligns itself over a package **84**. **FIG. 5** shows transporter **10** in the lowered position over package **84** or another processing station. Donut **82** is lowered into package **84** and piston **24** is in the second, lowered, position such

that transporter **10** still is holding on to donut **82**. **FIG. 6** shows transporter **10** still in the lowered position with piston **24** in the first, raised, position. Placing piston **24** in the first, raised, position causes arms **22** to retract into bore **28** of shell **14**. Thus, donut **82** is released from the grasp of transporter **10**. **FIG. 7** shows transporter **10** in a raised position above package **84** with donut **82** remaining in package **84**. Once in the raised position, transporter **10** travels throughout the facility to position itself above another donut **82**.

[**0033**] It should be appreciated that the force exerted by arms **22** on donut **82** is of a magnitude that binds donut **82** between arms **22** and contact surfaces **34** but does not crush donuts **82**. Alternatively, the force exerted by arms **22** is just greater than the weight of donut **82** such that the weight of donut **82** does not cause significant deflection of arms **22** and does not allow donut **82** to fall.

[**0034**] All parts of transporter **10** are preferably manufactured out of materials so as to preserve the sanitary conditions of food production, packaging, and distribution facilities where transporter **10** is located. Such a material, for example, is stainless steel.

[**0035**] While the invention is susceptible to various modifications and alternative forms, exemplary embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

1-20. (canceled)

21. A transport device comprising;

an actuator;

a body coupled to the actuator having an abutment surface; and

a plurality of arms coupled to the actuator that selectively extend from and retract into the body, extension of the arms from the body providing for grasping of an item between the arms and the abutment surface.

22. The transport of claim 21, wherein the arms are sized and shaped to enter a void in the item.

23. The transport of claim 21, wherein the arms are flexible such that the arms expand as the arms extend from the body and the arms contract as the arms retract into the body.

24. The transport of claim 23, wherein the expansion and contraction of the arms is governed by walls of an internal aperture of the body.

25. The transport of claim 21, wherein the actuator is a pneumatic cylinder.

26. The transport of claim 21, wherein the arms are springs.

27. The transport of claim 26, wherein the springs have a spring constant to allow the carrying of a baked good while substantially maintaining the shape and integrity of the baked good.

* * * * *