US 20140023537A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2014/0023537 A1

(43) Pub. Date: Jan. 23, 2014

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(54) AIR PUMP CYLINDER

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(21) Appl. No.: **13/552,713**

(22) Filed: **Jul. 19, 2012**

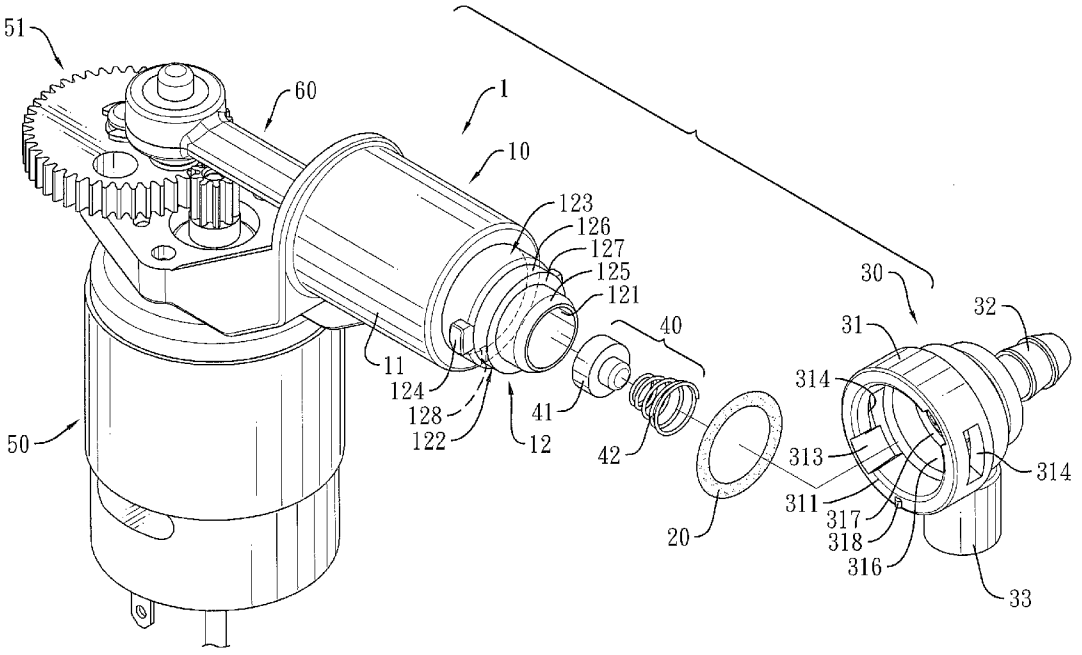
Publication Classification

(51) **Int. Cl.**
F04B 41/00 (2006.01)

(52) **U.S. Cl.**
USPC **417/437**

(57) **ABSTRACT**

An air pump cylinder has a housing, a cover and an O-ring. The housing includes a connecting tube. The connecting tube has a plurality of projections extending therefrom. The cover is hermetically engaged with the connecting tube of the housing and includes a cap. The cap has an annular sidewall and a plurality of grooves. The grooves are formed in the annular sidewall and each groove has an axial portion and a locking portion. The projections of the connecting tube of the housing are disposed into the axial portions of the grooves and the cover is then rotated to make the projections engage the locking portions of grooves and to make the O-ring tightly clamped between the connecting tube of the housing and the cap of the cover. Therefore, the air pump cylinder can be easily assembled and manufactured without the use of bolts.



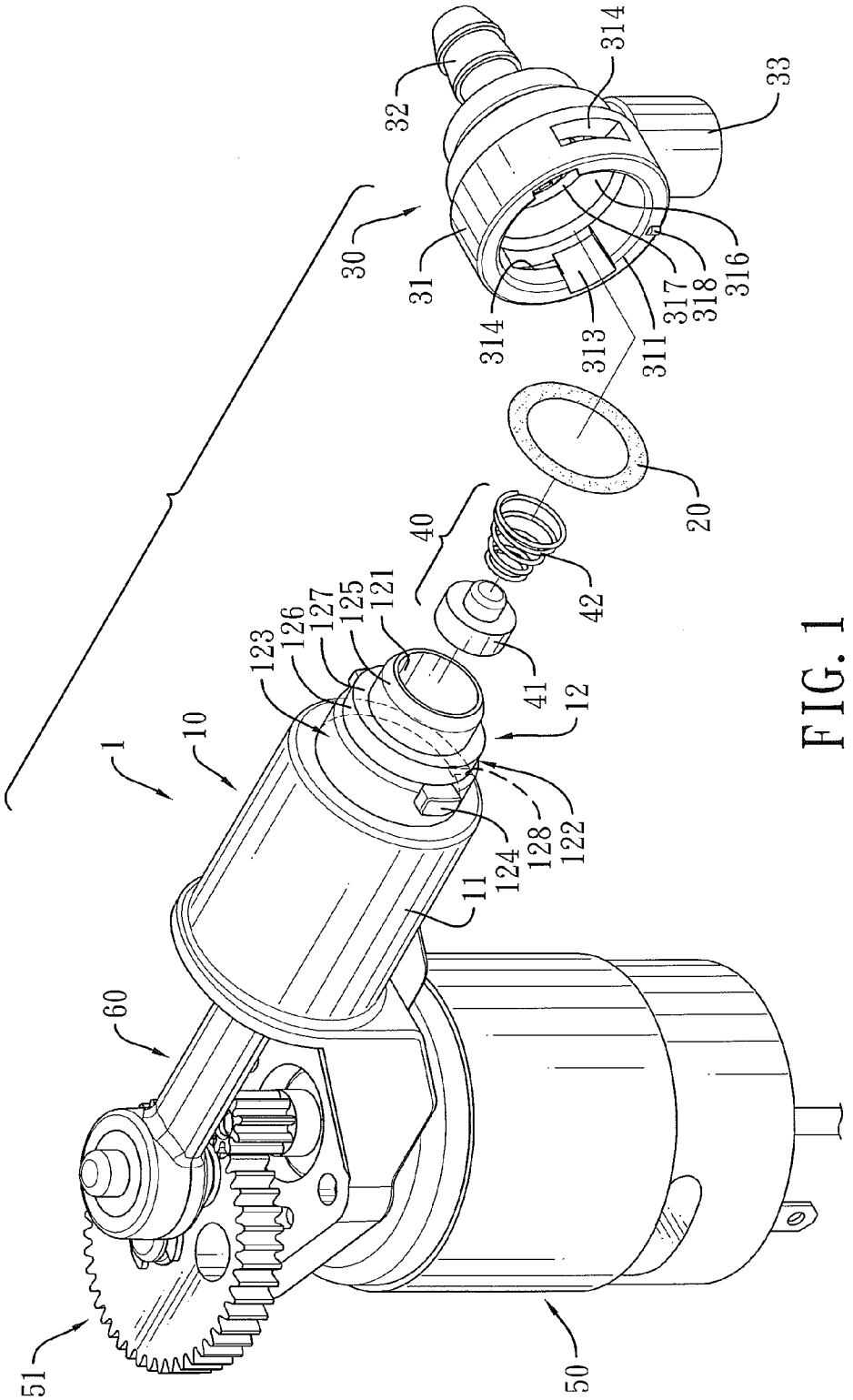

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FIG. 1

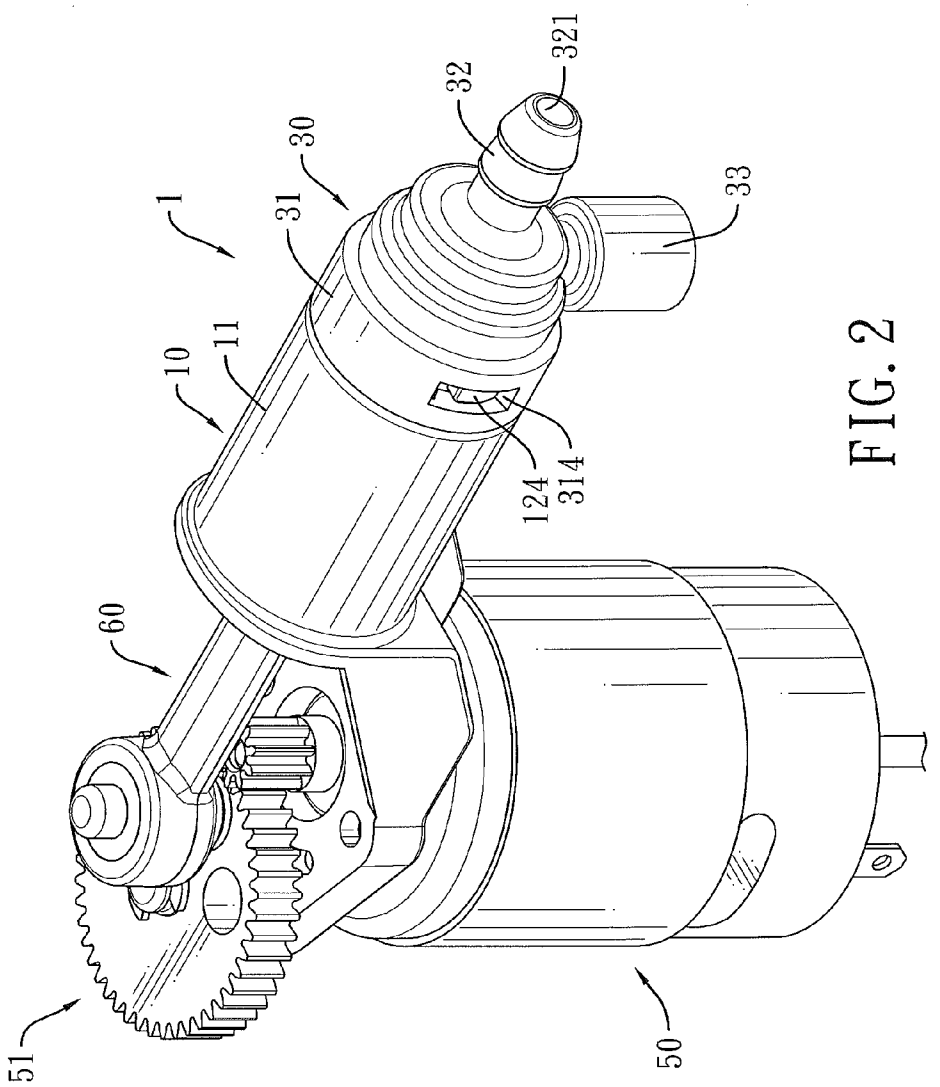

FIG. 2

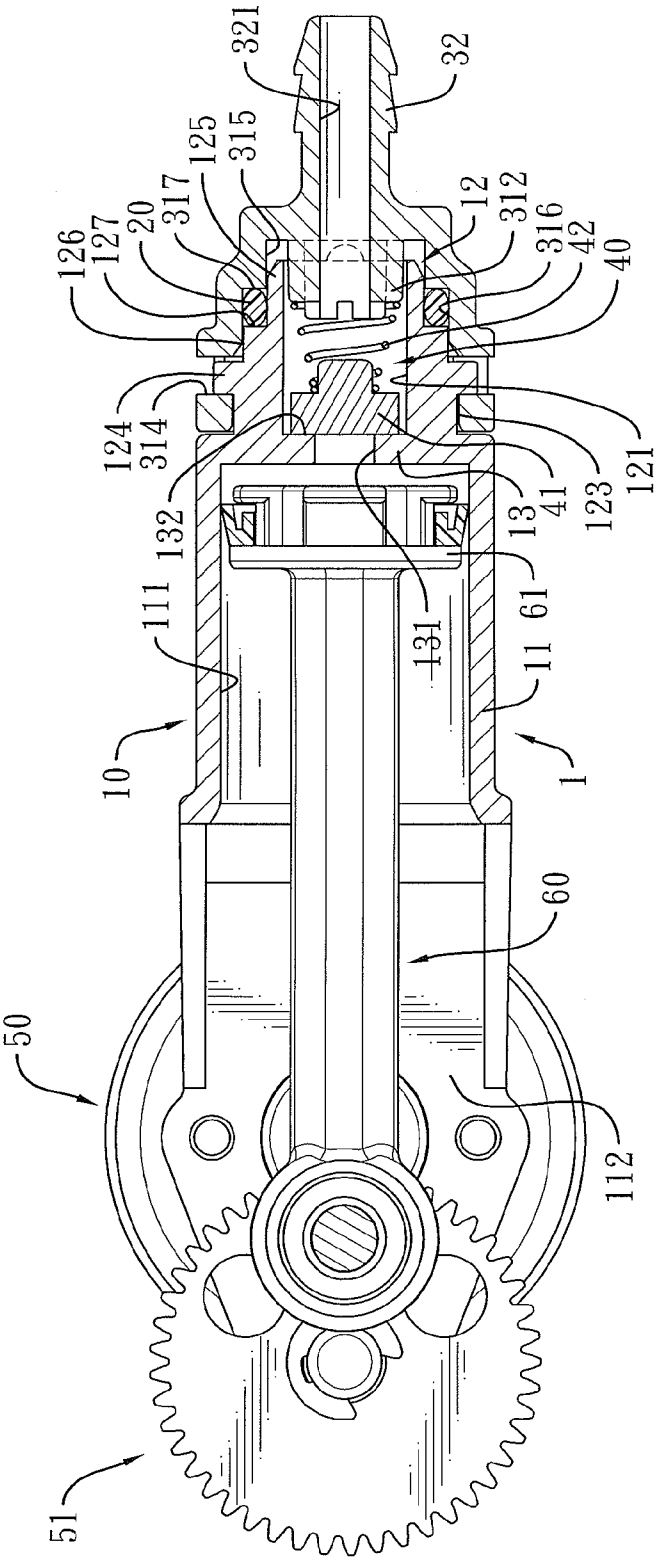
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FIG. 3

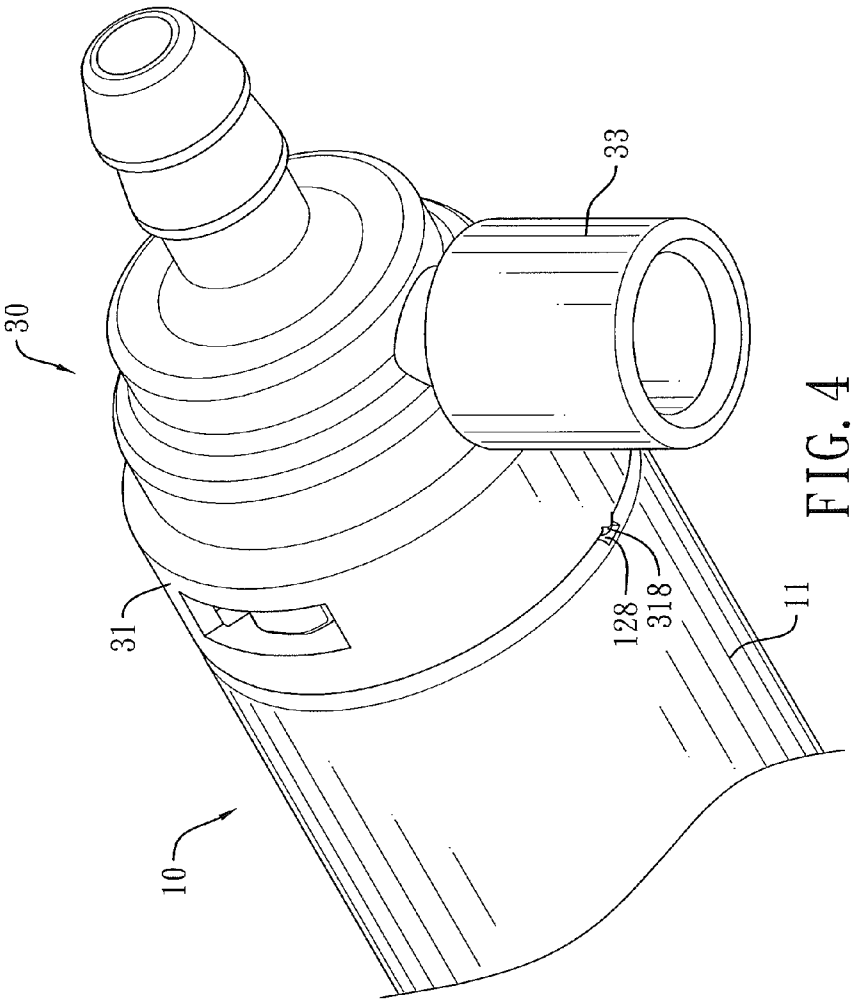

FIG. 4

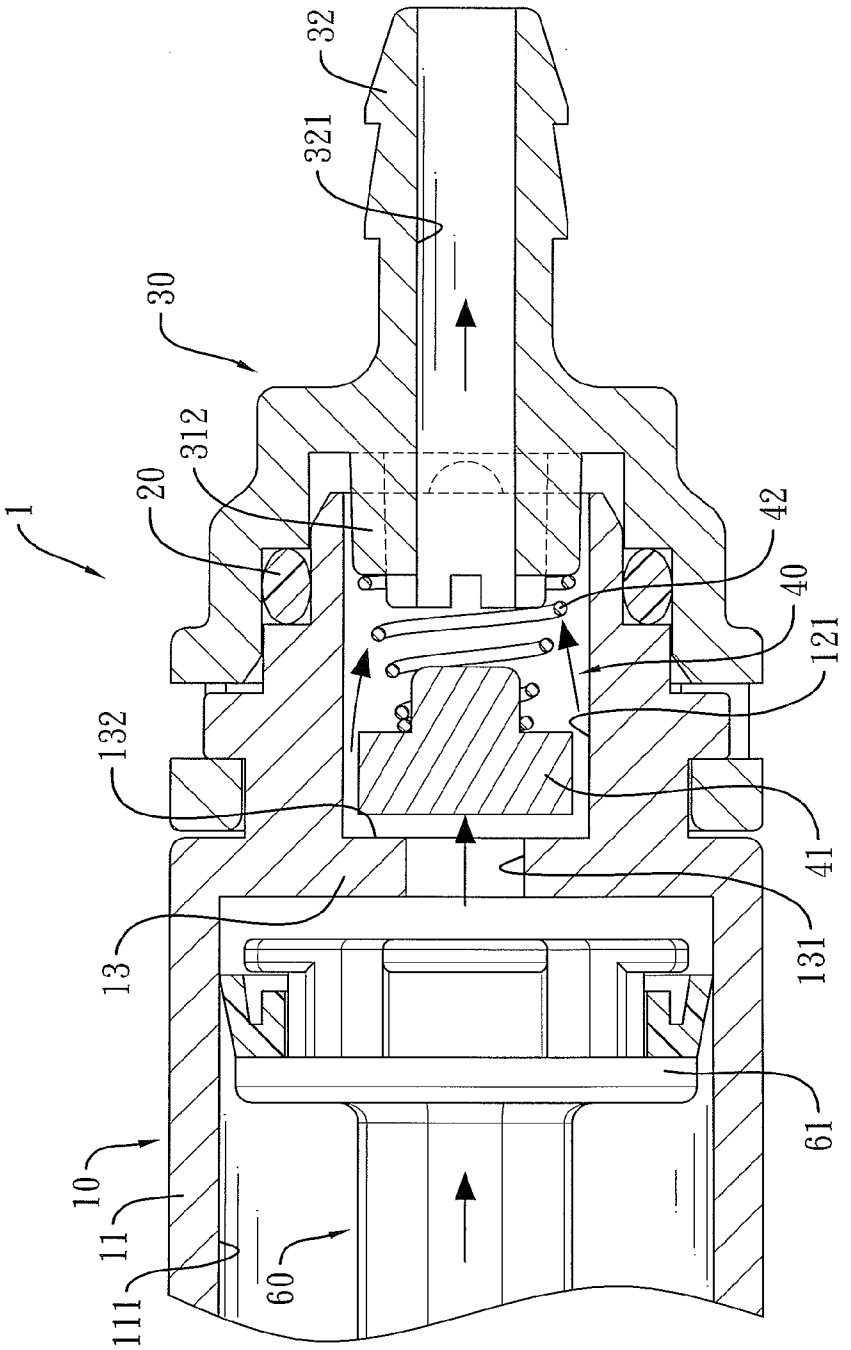

FIG. 5

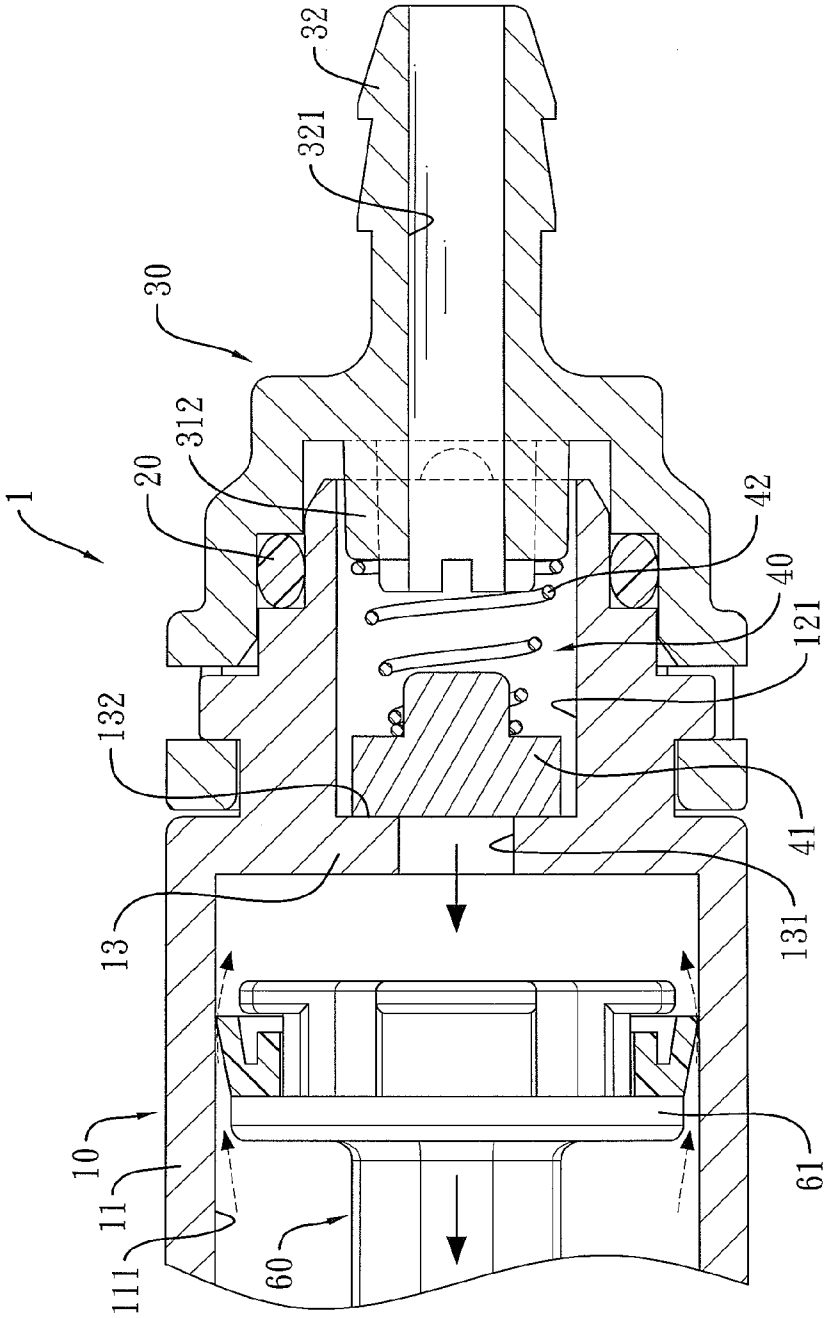

FIG. 6

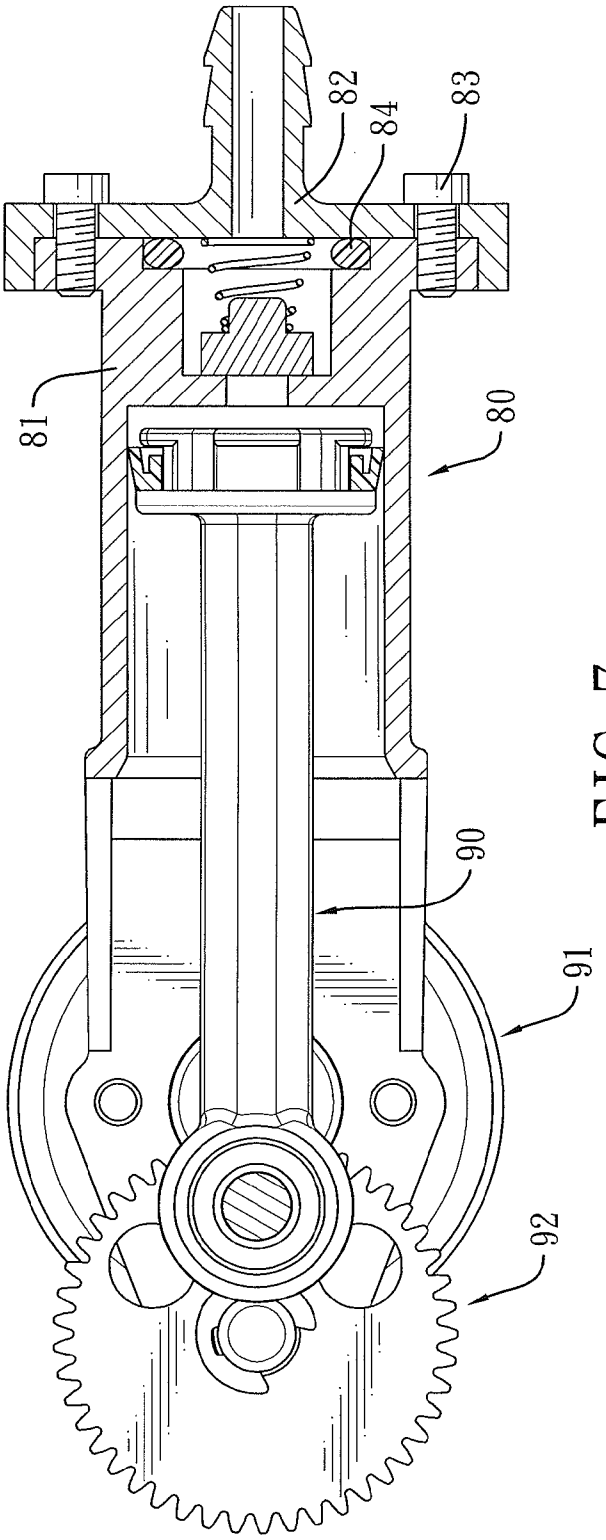

FIG. 7
PRIOR ART

AIR PUMP CYLINDER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention The present invention relates to an air pump, and more particularly to an air pump cylinder that can be easily and quickly assembled and manufactured.

[0002] 2. Description of the Prior Arts

[0003] An air pump is used to pump air and is driven by electricity or manual power. With reference to FIG. **7**, a conventional air pump driven by electricity comprises an air pump cylinder **80** and an electric drive mechanism. The air pump cylinder **80** includes a housing **81**, a cover **82**, a plurality of bolts **83** and an O-ring **84**. The housing **81** and the cover **82** are made of zinc alloy. The housing **81** has a plurality of threaded holes therethrough. The cover **82** has a plurality of through holes therethrough. The bolts **83** pass through the through holes of the cover **82** and are screwed into the threaded holes of the housing **81** to hermetically secure the cover **82** to the housing **81**. The O-ring **84** is clamped between the cover **82** and the housing **81**. A pipe has one end connected to the cover **82** and the other end connected to an inflatable article such as a tire tube. The electric drive mechanism includes a motor **91** and a gearing **92**. In operation, the motor **91** drives a piston rod **90** to move in a reciprocating motion in the housing **81** of the air pump cylinder **80** via the gearing **92**. The reciprocation of the piston rod **90** compresses air in the housing **81** and then the compressed air is ejected into the inflatable article for inflating the inflatable article.

[0004] However, hermetically securing the cover **82** to the housing **81** by means of bolts **83** requires a long processing time and thus reduces efficiency. In addition, forming the threaded holes through the zinc alloy housing **81** is troublesome and time-consuming.

[0005] To overcome the shortcomings, the present invention provides an air pump cylinder to mitigate or obviate the aforementioned problems.

SUMMARY OF THE INVENTION

[0006] The main object of the present invention is to provide an air pump cylinder that can be easily and quickly assembled and manufactured.

[0007] To achieve the foregoing objective, the air pump cylinder in accordance with the present invention comprises a housing, an O-ring and a cover. The housing includes a base tube and a connecting tube. The base tube has a front end and a piston chamber. The connecting tube is integrally formed on the front end of the base tube and has an outer surface, a valve chamber and a plurality of projections. The valve chamber communicates with the piston chamber of the base tube. The projections extend from the outer surface of the connecting tube. The O-ring is mounted around the connecting tube of the housing. The cover is hermetically engaged with the connecting tube of the housing and includes a cap. The cap has a closed front, an annular sidewall, a receiving chamber and a plurality of grooves. The annular sidewall has an inner surface. The receiving chamber receives the connecting tube of the housing and the O-ring. The grooves are formed in the inner surface of the annular sidewall, correspond to the projections of the connecting tube of the housing, and each groove has an axial portion and a locking portion. The locking portion extends from and communicates with a front end of the axial portion. The projections of the connecting tube of the housing are disposed into the axial portions of the grooves of the cap of the cover and the cover is then rotated to make the projections engage the locking portions of the grooves and to make the O-ring tightly clamped between the connecting tube of the housing and the cap of the cover. Therefore, the air pump cylinder can be easily and quickly assembled without the use of bolts. Besides, threaded holes through the housing are not required, thereby saving manufacturing time and cost.

[0008] Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a partially exploded perspective view of an air pump with an air pump cylinder in accordance with the present invention;

[0010] FIG. **2** is a perspective view of the air pump with the air pump cylinder in FIG. **1**;

[0011] FIG. **3** is a top view in partial section of the air pump with the air pump cylinder in FIG. **1**;

[0012] FIG. **4** is a partial perspective view of the air pump cylinder in FIG. **1**;

[0013] FIGS. **5** and **6** are partial enlarged top views of the air pump with the air pump cylinder in FIG. **1** showing that the air pump is pumping air; and

[0014] FIG. **7** is a top view in partial section of a conventional air pump in accordance with the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] With reference to FIGS. **1** to **3**, an air pump cylinder **1** in accordance with the present invention comprises a housing **10**, an O-ring **20** and a cover **30**.

[0016] The housing **10** is made of plastic or alloy, is integrally formed as one piece and includes a base tube **11**, a connecting tube **12** and an interface wall **13**. The base tube **11** has a front end, a rear end **112** and a piston chamber **111**. The piston chamber **111** is defined in the base tube **11**. A piston rod **60** is inserted in the piston chamber **111** from the rear end **112**. The connecting tube **12** is formed on the front end of the base tube **11** and has an outer surface, a valve chamber **121**, and a plurality of projections **124**. The valve chamber **121** is defined in the connecting tube **12** for receiving a valve **40** that includes a body **41** and a spring **42**. The projections **124** extend from the outer surface of the connecting tube **12**. The interface wall **13** is formed between the base tube **11** and the connecting tube **12** and has a center, a hole **131** and an abutting surface **132**. The hole **131** is formed through the center of the interface wall **13** and communicates with the piston chamber **111** of the base tube **11** and the valve chamber **121** of the connecting tube **12**. The abutting surface **132** is formed around the hole **131**. The body **41** of the valve **40** abuts the abutting surface **132**.

[0017] The O-ring **20** is made of a resilient material such as rubber and is mounted around the connecting tube **12** of the housing **10**.

[0018] The cover **30** is made of plastic or alloy, is integrally formed as one piece, is hermetically engaged with the connecting tube **12** of the housing **10** and includes a cap **31** and a joint **32**. The cap **31** has a closed front, an open rear, an annular sidewall, a receiving chamber **311**, a block **312** and a plurality of grooves **313**. The closed front has an inner surface

and an outer surface. The annular sidewall has an inner surface. The receiving chamber **311** is defined between the closed front and the annular sidewall of the cap **31** for receiving the connecting tube **12** of the housing **10** and the O-ring **20**. The block **312** extends from the inner surface of the closed front. The spring **42** of the valve **40** is compressed between the block **312** and the body **41** of the valve **40**. The grooves **313** are formed in the inner surface of the annular sidewall, correspond to the projections **124** of the connecting tube **12** of the housing **10** and each groove **313** has an axial portion and a locking portion **314**. The locking portion **314** extends from and communicates with a front end of the axial portion. The projections **124** of the connecting tube **12** of the housing **10** are disposed into the axial portions of the grooves **313** and the cover **30** is then rotated to make the projections **124** engage the locking portions **314** of grooves **313** and to make the O-ring **20** tightly clamped between the connecting tube **12** of the housing **10** and the cap **31** of the cover **30**. The O-ring **20** creates a seal between the housing **10** and the cover **30**. The O-ring **20** provides a resilient force to the housing **10** and the cover **30** so that the housing **10** and the cover **30** are firmly connected to each other. Besides, the compressed spring **42** provides a restoring force to the housing **10** and the cover **30** to connect the housing **10** and the cover **30** as well.

[0019] The joint **32** is formed on the outer surface of the closed front of the cap **31** and has a passage **321**. The passage **321** is defined in the joint **32** and extends through the block **312** of the cap **31** to communicate with the receiving chamber **311** of the cap **31**. The joint **32** is connected to one end of a pipe and the other end of the pipe is connected to an inflatable article. Further, a pressure gauge connector **33** is mounted on the annular sidewall of the cap **31**, is connected to a pressure gauge and has an interior communicating with the receiving chamber **311** of the cap **31**.

[0020] In a preferred embodiment, the connecting tube **12** of the housing **10** has a cylindrical rear portion **123** and a cylindrical front portion **122**. The rear portion **123** extends from a front surface of the interface wall **13** of the housing **10** and has a front surface, an outer surface and an outer diameter. The projections **124** extend from the outer surface of the rear portion **123**. The front portion **122** has a cylindrical first step **126**, a cylindrical second step **125** and an annular step surface **127**. The first step **126** extends from the front surface of the rear portion **123** and has a front surface and an outer diameter. The outer diameter of the first step **126** is smaller than the outer diameter of the rear portion **123**. The second step **125** extends from the front surface of the first step **126** and has an outer diameter. The outer diameter of the second step **125** is smaller than the outer diameter of the first step **126**. The step surface **127** is formed between the first step **126** and the second step **125**.

[0021] The receiving chamber **311** of the cap **31** of the cover **30** has a first tank **316**, a second tank **315** and an annular step surface **317**. The first tank **316** extends through the cap **31** from the open rear and has an inner diameter. The inner diameter of the first tank **316** corresponds to the outer diameter of the first step **126** of the front portion **122**. The second tank **315** extends through the cap **31**, communicates with the first tank **316** and has an inner diameter. The inner diameter of the second tank **315** corresponds to the outer diameter of the second step **125** of the front portion **122**. The step surface **317** is formed between the first tank **316** and the second tank **315** and corresponds to the step surface **127** of the front portion **122**. The O-ring **20** is mounted around the second step **125** of the front portion **122**, is disposed in the first tank **316** of the receiving chamber **311** and is tightly clamped between the step surface **127** of the front portion **122** and the step surface **317** of the receiving chamber **311**.

[0022] With reference to FIG. **4**, the housing **10** has a recess **128** and the annular sidewall of the cap **31** of the cover **30** has a boss **318** engaging the recess **128** to ensure that the cover **30** does not rotate relative to the housing **10**. Preferably, the recess **128** is formed in a periphery of the front surface of the interface wall **13** of the housing **10** and the boss **318** extends from a rear surface of the annular sidewall of the cap **31** of the cover **30**.

[0023] The air pump cylinder **1** in accordance with the present invention can be easily and quickly assembled by rotating the cover **30** at a small angle relative to the housing **10** without the use of bolts. Besides, threaded holes through the housing **10** are not required, thereby saving manufacturing time and cost.

[0024] The air pump cylinder **1** in accordance with the present invention is applied to an air pump that comprises a drive mechanism. The drive mechanism may be manual or electric. The drive mechanism as shown is electric and includes a motor **50** and a gearing **51**. In operation, the motor **50** drives the piston rod **60** to move in a reciprocating motion in the piston chamber **111** of the housing **10** via the gearing **51**. With reference to FIG. **5**, each time a piston **61** of the piston rod **60** is moved toward the valve **40**, air is compressed by the piston **61**. The compressed air pushes the body **41** against the restoring force of the spring **42** to open the hole **131** of the housing **10** and then ejects into the inflatable article through the passage **321** of the cover **30** for inflating the inflatable article. With reference to FIG. **6**, each time the piston **61** of the piston rod **60** is moved away from the valve **40**, a negative pressure in the piston chamber **111** is generated so that ambient air can flow into the piston chamber **111** through a gap between an outer surface of the piston **61** and an inner surface of the base tube **11**. Thus, a pumping effect is achieved.

[0025] Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and features of the invention, the disclosure is illustrative only. Changes may be made in the details, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. An air pump cylinder comprising:

a housing including:

a base tube having:

a front end, and

a piston chamber defined in the base tube; and

a connecting tube integrally formed on the front end of the base tube and having:

an outer surface;

a valve chamber defined in the connecting tube and communicating with the piston chamber of the base tube; and

a plurality of projections extending from the outer surface of the connecting tube;

an O-ring made of a resilient material and mounted around the connecting tube of the housing; and

a cover hermetically engaged with the connecting tube of the housing and including:
a cap having:
a closed front;
an annular sidewall having an inner surface;
a receiving chamber defined between the closed front and the annular sidewall of the cap for receiving the connecting tube of the housing and the O-ring; and
a plurality of grooves formed in the inner surface of the annular sidewall, corresponding to the projections of the connecting tube of the housing and each groove having:
an axial portion; and
a locking portion extending from and communicating with a front end of the axial portion; and
a joint integrally formed on the closed front of the cap and having a passage defined therein and communicating with the receiving chamber of the cap; and
wherein the projections of the connecting tube of the housing are disposed into the axial portions of the grooves and the cover is then rotated to make the projections engage the locking portions of grooves and to make the O-ring tightly clamped between the connecting tube of the housing and the cap of the cover.

2. The air pump cylinder as claimed in claim **1**, wherein the connecting tube of the housing has
a cylindrical rear portion extending from the front end of the base tube and having:
a front surface;
an outer surface from which the projections extend; and
an outer diameter; and
a cylindrical front portion having:
a cylindrical first step extending from the front surface of the rear portion and having:
a front surface; and
an outer diameter being smaller than the outer diameter of the rear portion;
a cylindrical second step extending from the front surface of the first step and having an outer diameter being smaller than the outer diameter of the first step; and
an annular step surface formed between the first step and the second step; and
the receiving chamber of the cap of the cover has
a first tank extending through the cap from an open rear thereof and having an inner diameter corresponding to the outer diameter of the first step of the front portion;
a second tank extending through the cap, communicating with the first tank and having an inner diameter corresponding to the outer diameter of the second step of the front portion; and
an annular step surface formed between the first tank and the second tank and corresponding to the step surface of the front portion; and
wherein the O-ring is mounted around the second step of the front portion, is disposed in the first tank of the receiving chamber and is tightly clamped between the step surface of the front portion and the step surface of the receiving chamber.

3. The air pump cylinder as claimed in claim **1**, wherein the housing includes an interface wall formed between the base tube and the connecting tube and having:
a center;
a hole formed through the center of the interface wall and communicating with the piston chamber of the base tube and the valve chamber of the connecting tube; and
an abutting surface formed around the hole.

4. The air pump cylinder as claimed in claim **2**, wherein the housing includes an interface wall formed between the base tube and the connecting tube and having:
a center;
a hole formed through the center of the interface wall and communicating with the piston chamber of the base tube and the valve chamber of the connecting tube; and
an abutting surface formed around the hole.

5. The air pump cylinder as claimed in claim **4** further having a pressure gauge connector mounted on the annular sidewall of the cap of the cover and having an interior communicating with the receiving chamber of the cap.

6. The air pump cylinder as claimed in claim **1**, wherein the housing has a recess and the annular sidewall of the cap of the cover has a boss engaging the recess.

7. The air pump cylinder as claimed in claim **2**, wherein the housing has a recess and the annular sidewall of the cap of the cover has a boss engaging the recess.

8. The air pump cylinder as claimed in claim **3**, wherein the interface wall of the housing has a recess and the annular sidewall of the cap of the cover has a boss engaging the recess.

9. The air pump cylinder as claimed in claim **4**, wherein the interface wall of the housing has a recess and the annular sidewall of the cap of the cover has a boss engaging the recess.

10. The air pump cylinder as claimed in claim **5**, wherein the interface wall of the housing has a recess and the annular sidewall of the cap of the cover has a boss engaging the recess.

11. The air pump cylinder as claimed in claim **6**, wherein
the recess is formed in a periphery of a front surface of an interface wall of the housing; and
the boss extends from a rear surface of the annular sidewall of the cap of the cover.

12. The air pump cylinder as claimed in claim **7**, wherein
the recess is formed in a periphery of a front surface of an interface wall of the housing; and
the boss extends from a rear surface of the annular sidewall of the cap of the cover.

13. The air pump cylinder as claimed in claim **8**, wherein
the recess is formed in a periphery of a front surface of the interface wall of the housing; and
the boss extends from a rear surface of the annular sidewall of the cap of the cover.

14. The air pump cylinder as claimed in claim **9**, wherein
the recess is formed in a periphery of a front surface of the interface wall of the housing; and
the boss extends from a rear surface of the annular sidewall of the cap of the cover.

15. The air pump cylinder as claimed in claim **10**, wherein
the recess is formed in a periphery of a front surface of the interface wall of the housing; and
the boss extends from a rear surface of the annular sidewall of the cap of the cover.

* * * * *