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ELECTRIC AIR PUMP

Abstract

An electric air pump includes a power unit and an inflating unit. The power unit includes a first housing and a motor. The inflating unit includes a second housing and an eccentric cam member. The power unit is configured to connect to the inflating unit in either a first position or a second position. When the power unit is in the first position, the motor is detached from the eccentric cam member. When the power unit is in the second position, the motor is connected to the eccentric cam member. When the power unit is in the third position, the power unit and the inflating unit are completely separated from each other.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] The present application is a continuation-in-part of U.S. patent application Ser. No. 18/346,401, filed on Jul. 3, 2023, now pending, the entire disclosure of which is incorporated herein by reference in its entirety for all purposes.

BACKGROUND OF THE INVENTION
[0002] The present invention relates to an electric air pump and, more particularly, to a portable electric air pump.
[0003] Although conventional electric inflators can inflate tires, they still has the problem of inconvenient holding during operation. For example, China Utility Model Patent No. CN203948244U discloses an electric inflator, which has a substantially cylindrical appearance as a whole that is inconvenient to hold during the inflation process. Similarly, Chinese Utility Model Patent No. CN204344405U discloses another electric inflator, which has a substantially square appearance as a whole that is also inconvenient to hold.
[0004] Thus, a need exists for an electric air pump to mitigate and/or obviate the above disadvantages.
SUMMARY OF THE INVENTION
[0005] An objective of the present invention is to provide an electric air pump that includes a power unit and an inflating unit. The power unit includes a first housing, a battery disposed inside the first housing, a control circuit board electrically coupled to the battery, and a motor electrically coupled to the control circuit board. The inflating unit includes a second housing, an eccentric cam member disposed inside the second housing, a linking member connected to the eccentric cam member, a piston arranged at one end of the linking member, a cylinder member accommodating the piston, and a connecting member arranged at one end of the cylinder member. The eccentric cam member is detachably connected to the motor. The connecting member is adapted for connecting to an air valve. The power unit is configured to connect to the inflating unit in one of a first position, a second position, or a third position. When the power unit is in the first position, the motor is detached from the eccentric cam member. When the power unit is in the second position, the motor is connected to the eccentric cam member. When the power unit is in the third position, the power unit and the inflating unit are completely separated from each other.
[0006] In an embodiment, the first housing extends along a first reference axis. The second housing extends along a second reference axis. When the power unit is in the first position, the first reference axis is coaxial with the second reference axis. When the power unit is in the second position, the first reference axis intersects with the second reference axis.
[0007] In an embodiment, the power unit is provided with a first engaging portion on the first housing. The inflating unit is provided with a second engaging portion on the second housing and a third engaging portion on the cylinder member. When the power unit is in the first position, the first engaging portion is engaged with the second engaging portion. When the power unit is in the second position, the first engaging portion is engaged with the third engaging portion. When the power unit is in the third position, the first engaging portion is disengaged from both the second engaging portion and the third engaging portion.
[0008] In an embodiment, the first engaging portion is formed on a first end face of the first housing and includes a pair of symmetrical first engaging protrusions. Each of the pair first engaging protrusions has a first engaging slot on an outer side thereof. The second engaging portion is formed on a second end face of the second housing and includes a pair of symmetrical second engaging protrusions. The pair of second engaging protrusions is adjacent to a pair of symmetrical second engaging slots. The third engaging portion is formed on an extension portion

of the cylinder member and includes a pair of symmetrical third engaging protrusions. Each of the pair of third engaging protrusions forms a third engaging slot on an outer side thereof. When the power unit is in the first position, the pair of first engaging slots is engaged with the pair of second engaging protrusions. When the power unit is in the second position, the pair of first engaging slots is engaged with the pair of third engaging slots. When the power unit is in the third position, the pair of first engaging slots is disengaged from both the pair of second engaging protrusions and the pair of third engaging slots.

[0009] In an embodiment, the pair of first engaging protrusions, the pair of second engaging protrusions, and the pair of third engaging protrusions are each curved in shape.

[0010] In an embodiment, the first housing is provided with a first through-hole penetrating through the first end face along the first reference axis and disposed between the pair of first engaging protrusions. The motor has a rotating shaft inserted into the first through-hole and a meshing member disposed at one end of the rotating shaft and disposed outside the first housing. The second housing is provided with a second through-hole penetrating through the second end face along the second reference axis, a third end face adjacent to the second end face, and a third through-hole penetrating through the third end face. The eccentric cam member is provided with a meshing groove detachably engaged with the meshing member. When the power unit is in the first position, the meshing member extends into the second through-hole. When the power unit is in the second position, the meshing member extends into the third through-hole and engages with the meshing groove.

[0011] In an embodiment, the eccentric cam member is provided with an eccentric connecting column. One end of the linking member opposite to the piston has a connecting hole sleeved onto the eccentric connecting column. The extension portion of the cylinder member forms a fourth through-hole corresponding to the third through-hole. The eccentric cam member is rotatably arranged in the fourth through-hole.

[0012] In an embodiment, the piston is provided with a unidirectional sealing ring on an outer periphery thereof. The cylinder member is further provided with a chamber extending along the second reference axis. The unidirectional sealing ring abuts against an inner surface of the chamber.

[0013] In an embodiment, the cylinder member is further provided with a threaded hole communicating with the chamber. The connecting member is provided with a threaded portion formed on an outer periphery thereof and detachably engaging with the threaded hole, and a connecting hole extending along the second reference axis. The connecting member is further provided with an airtight member disposed in the connecting hole and adapted for clamping the air valve.

[0014] In an embodiment, the first housing is further provided with an aperture. The control circuit board has an activation control button exposed outside the first housing through the aperture.

[0015] The present invention will become clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0016] FIG. **1** is a perspective view of an electric air pump of an embodiment according to the present invention, showing the power unit in a first position.

[0017] FIG. **2** is an exploded perspective view of the electric air pump of FIG. **1**.

[0018] FIG. **3** is another exploded perspective view of the electric air pump of FIG. **1** from a different angle.

[0019] FIG. **4** is a cross sectional view of the electric air pump of FIG. **1**, showing the power unit in the first position.

[0020] FIG. **5** is a cross-sectional view showing the power unit and the inflating unit completely separated from each other after being in the first position.
[0021] FIG. **6** is a cross sectional view of the electric air pump of the embodiment according to the present invention, showing the power unit in a second position.
[0022] FIG. **7** is a cross-sectional view showing the power unit and the inflating unit completely separated from each other after being in the second position.
[0023] FIG. **8** is a perspective view of the electric air pump of the embodiment according to the present invention, showing the power unit in the second position.
[0024] FIG. **9** is a perspective view showing a different power unit about to be attached to the inflating unit.

DETAILED DESCRIPTION OF THE INVENTION

[0025] FIGS. **1**-**9** show an electric air pump of an embodiment according to the present invention. The electric air pump includes a power unit **10** and an inflating unit **20**. The power unit **10** includes a first housing **11**, a battery **12** disposed inside the first housing **11**, a control circuit board **13** electrically coupled to the battery **12**, and a motor **14** electrically coupled to the control circuit board **13**. The inflating unit **20** includes a second housing **21**, an eccentric cam member **22** disposed inside the second housing **21**, a linking member **23** connected to the eccentric cam member **22**, a piston **24** arranged at one end of the linking member **23**, a cylinder member **25** accommodating the piston **24**, and a connecting member **26** arranged at one end of the cylinder member **25**. The eccentric cam member **22** is detachably connected to the motor **14**, and the connecting member **26** is adapted for connecting to an air valve of an inflatable object such as a tire. The power unit **10** is configured to connect to the inflating unit **20** in one of a first position, a second position, or a third position. When the power unit **10** is in the first position, the motor **14** is detached from the eccentric cam member **22**. When the power unit **10** is in the second position, the motor **14** is connected to the eccentric cam member **22** and can drive the eccentric cam member **22** to propel the linking member **23** and the piston **24** to compress the air in the cylinder member **25**, thereby inflating the air valve connected to the connecting member **26**. When the power unit **10** is in the third position, the power unit **10** and the inflating unit **20** are completely separated from each other (as shown in FIGS. **5** and **7**).
[0026] Further, the first housing **11** extends along a first reference axis A**11**, and the second housing **21** extends along a second reference axis A**21**. When the power unit **10** is in the first position, the first reference axis A**11** is coaxial with the second reference axis A**21** so that the power unit **10** and the inflating unit **20** forms a compact linear appearance (as shown in FIG. **1**), allowing the electric air pump to facilitate storage or portability. When the power unit **10** is in the second position, the first reference axis A**11** intersects with the second reference axis A**21** so that the power unit **10** and the inflating unit **20** forms a handgun appearance (as shown in FIG. **8**), allowing the first housing **11** easy to be hold during the inflation.
[0027] The power unit **10** is provided with a first engaging portion **15** on the first housing **11**, and the inflating unit **20** is provided with a second engaging portion **27** on the second housing **21** and a third engaging portion **28** on the cylinder member **25**. When the power unit **10** is in the first position, the first engaging portion **15** is engaged with the second engaging portion **27**. When the power unit **10** is in the second position, the first engaging portion **15** is engaged with the third engaging portion **28**. When the power unit **10** is in the third position, the first engaging portion **15** is disengaged from both the second engaging portion **27** and the third engaging portion **28**.
[0028] Further, the first engaging portion **15** is formed on a first end face **111** of the first housing **11** and includes a pair of symmetrical first engaging protrusions **151**, and each of the pair of first engaging protrusions **151** has a first engaging slot **152** on an outer side thereof. The second engaging portion **27** is formed on a second end face **211** of the second housing **21** and includes a pair of symmetrical second engaging protrusions **271**, and the pair of second engaging protrusions **271** is adjacent to a pair of symmetrical second engaging slots **272**. The third engaging portion **28**

is formed on an extension portion **251** of the cylinder member **25** and includes a pair of symmetrical third engaging protrusions **281**, and each of the pair of third engaging protrusions **281** forms a third engaging slot **282** on an outer side thereof. When the power unit **10** is in the first position, the pair of first engaging slots **152** is engaged with the pair of second engaging protrusions **271**. When the power unit **10** is in the second position, the pair of first engaging slots **152** is engaged with the pair of third engaging slots **282**. When the power unit **10** is in the third position, the pair of first engaging slots **152** is disengaged from both the pair of second engaging protrusions **271** and the pair of third engaging slots **282**.

[0029] In the embodiment, the pair of first engaging protrusions **151**, the pair of second engaging protrusions **271**, and the pair of third engaging protrusions **281** are each curved in shape.

[0030] The first housing **11** is provided with a first through-hole **112** penetrating through the first end face **111** along the first reference axis A**11** and disposed between the pair of first engaging protrusions **151**. The motor **14** has a rotating shaft **141** inserted into the first through-hole **112** and a meshing member **142** disposed at one end of the rotating shaft **141** and disposed outside the first housing **11**. The second housing **21** is provided with a second through-hole **212** penetrating through the second end face **211** along the second reference axis A**21**, a third end face **213** adjacent to the second end face **211**, and a third through-hole **214** penetrating through the third end face **213**. The eccentric cam member **22** is provided with a meshing groove **221** detachably engaged with the meshing member **142**. When the power unit **10** is in the first position, the meshing member **142** extends into the second through-hole **212** and the motor **14** is unable to drive eccentric cam member **22**. When the power unit **10** is in the second position, the meshing member **142** extends into the third through-hole **214** and engages with the meshing groove **221**, allowing the motor **14** to drive the eccentric cam member **22** to propel the linking member **23** and the piston **24**.

[0031] Further, the eccentric cam member **22** is provided with an eccentric connecting column **222**. One end of the linking member **23** opposite to the piston **24** has a connecting hole **231** sleeved onto the eccentric connecting column **222**. The extension portion **251** of the cylinder member **25** forms a fourth through-hole **252** corresponding to the third through-hole **214**, and the eccentric cam member **22** is rotatably arranged in the fourth through-hole **252**.

[0032] The piston **24** is provided with a unidirectional sealing ring **241** on an outer periphery thereof, and the cylinder member **25** is further provided with a chamber **253** extending along the second reference axis A**21**. The unidirectional sealing ring **241** abuts against an inner surface of the chamber **253**, allowing the high pressure air compressed by piston **24** within chamber **253** to flow towards the connecting member **26** and preventing reverse flow of high pressure air.

[0033] The cylinder member **25** is further provided with a threaded hole **254** communicating with the chamber **253**. The connecting member **26** is provided with a threaded portion **261** formed on an outer periphery thereof and detachably engaging with the threaded hole **254**, and a connecting hole **262** extending along the second reference axis A**21**. The connecting member **26** is further provided with an airtight member **263** disposed in the connecting hole **262** and adapted for clamping the air valve.

[0034] The first housing **11** is further provided with an aperture **113**, and the control circuit board **13** has an activation control button **131** exposed outside the first housing **11** through the aperture **113** so that the user can press the activation control button **131** to control the power supply of battery **12** and enable the operation of motor **14**.

[0035] The pair of first engaging protrusions **151** of the first engaging portion **15** can enter the pair of second engaging slots **272** of the second engaging portion **27**, and then the first housing **11** and the second housing **21** can be relative rotated to cause the pair of first engaging slots **152** engaged with the pair of second engaging protrusions **271**. Thus, the first engaging portion **15** is engaged with the second engaging portion **27** and the power unit **10** is in the first position, the first reference axis A**11** is coaxial with the second reference axis A**21** so that the power unit **10** and the inflating unit **20** forms the compact linear appearance, allowing the electric air pump to facilitate storage or

portability. The user can rotate the first housing **11** relative to the second housing **21** in the reverse direction, causing the pair of first engaging slots **152** to disengage from the pair of second engaging protrusions **271** to separate the first housing **11** and the second housing **21**.

[0036] The pair of first engaging protrusions **151** can engage with a pair of symmetrical third engaging protrusions **281**, and then the first housing **11** and the second housing **21** can be relative rotated to cause the pair of first engaging slots **152** engaged with the pair of third engaging slots **282**. Thus, the first engaging portion **15** is engaged with the third engaging portion **28** and the power unit **10** is in the second position, the first reference axis A**11** intersects with the second reference axis A**21** so that the power unit **10** and the inflating unit **20** forms a handgun appearance, allowing the first housing **11** easy to hold during the inflation. The user can rotate the first housing **11** relative to the second housing **21** in the reverse direction, causing the pair of first engaging slots **152** to disengage from the pair of third engaging slots **282** to separate the first housing **11** and the second housing **21**.

[0037] The power unit **10** and the inflating unit **20** may be arranged in one of three positions to form three corresponding configurations. In the first position, the power unit **10** and the inflating unit **20** form a first configuration, in which the overall structure is approximately a compact linear appearance (as shown in FIG. **1**). This configuration allows the electric air pump to be compact in shape, thereby facilitating storage and portability. In the second position, the power unit **10** and the inflating unit **20** form a second configuration, in which the overall structure is approximately a handgun appearance (as shown in FIG. **8**). In this configuration, the user can easily grip the first housing **11** of the power unit **10**, which is advantageous during inflation operations. In the third position, the power unit **10** and the inflating unit **20** are completely separated from each other (as shown in FIGS. **5** and **7**). This configuration allows the user to replace the power unit **10** with a new one, such as power unit **10***a* (as shown in FIG. **9**), when the battery **12** is depleted or the power unit **10** is damaged, thereby avoiding scrapping the entire electric air pump and improving maintenance convenience and cost efficiency.

[0038] Although specific embodiments have been illustrated and described, numerous modifications and variations are still possible without departing from the scope of the invention. The scope of the invention is limited by the accompanying claims.

Claims

1. An electric air pump comprising: a power unit including a first housing, a battery disposed inside the first housing, a control circuit board electrically coupled to the battery, and a motor electrically coupled to the control circuit board; and an inflating unit including a second housing, an eccentric cam member disposed inside the second housing, a linking member connected to the eccentric cam member, a piston arranged at one end of the linking member, a cylinder member accommodating the piston, and a connecting member arranged at one end of the cylinder member, wherein the eccentric cam member is detachably connected to the motor, and wherein the connecting member is adapted for connecting to an air valve; wherein the power unit is configured to connect to the inflating unit in one of a first position, a second position, or a third position; wherein when the power unit is in the first position, the motor is detached from the eccentric cam member; wherein when the power unit is in the second position, the motor is connected to the eccentric cam member; wherein when the power unit is in the third position, the power unit and the inflating unit are completely separated from each other.

2. The electric air pump as claimed in claim 1, wherein the first housing extends along a first reference axis, wherein the second housing extends along a second reference axis; wherein when the power unit is in the first position, the first reference axis is coaxial with the second reference axis; wherein when the power unit is in the second position, the first reference axis intersects with the second reference axis.

3. The electric air pump as claimed in claim 2, wherein the power unit is provided with a first engaging portion on the first housing, wherein the inflating unit is provided with a second engaging portion on the second housing and a third engaging portion on the cylinder member; wherein when the power unit is in the first position, the first engaging portion is engaged with the second engaging portion; wherein when the power unit is in the second position, the first engaging portion is engaged with the third engaging portion; wherein when the power unit is in the third position, the first engaging portion is disengaged from both the second engaging portion and the third engaging portion.

4. The electric air pump as claimed in claim 3, wherein the first engaging portion is formed on a first end face of the first housing and includes a pair of symmetrical first engaging protrusions, wherein each of the pair of first engaging protrusions has a first engaging slot on an outer side thereof, wherein the second engaging portion is formed on a second end face of the second housing and includes a pair of symmetrical second engaging protrusions, wherein the pair of second engaging protrusions is adjacent to a pair of symmetrical second engaging slots, wherein the third engaging portion is formed on an extension portion of the cylinder member and includes a pair of symmetrical third engaging protrusions, and wherein each of the pair of third engaging protrusions forms a third engaging slot on an outer side thereof; wherein when the power unit is in the first position, the pair of first engaging slots is engaged with the pair of second engaging protrusions; wherein when the power unit is in the second position, the pair of first engaging slots is engaged with the pair of third engaging slots; wherein when the power unit is in the third position, the pair of first engaging slots is disengaged from both the pair of second engaging protrusions and the pair of third engaging slots.

5. The electric air pump as claimed in claim 4, wherein the pair of first engaging protrusions, the pair of second engaging protrusions, and the pair of third engaging protrusions are each curved in shape.

6. The electric air pump as claimed in claim 4, wherein the first housing is provided with a first through-hole penetrating through the first end face along the first reference axis and disposed between the pair of first engaging protrusions, wherein the motor has a rotating shaft inserted into the first through-hole and a meshing member disposed at one end of the rotating shaft and disposed outside the first housing, wherein the second housing is provided with a second through-hole penetrating through the second end face along the second reference axis, a third end face adjacent to the second end face, and a third through-hole penetrating through the third end face, wherein the eccentric cam member is provided with a meshing groove detachably engaged with the meshing member; wherein when the power unit is in the first position, the meshing member extends into the second through-hole; wherein when the power unit is in the second position, the meshing member extends into the third through-hole and engages with the meshing groove.

7. The electric air pump as claimed in claim 4, wherein the eccentric cam member is provided with an eccentric connecting column, wherein one end of the linking member opposite to the piston has a connecting hole sleeved onto the eccentric connecting column, wherein the extension portion of the cylinder member forms a fourth through-hole corresponding to the third through-hole, and wherein the eccentric cam member is rotatably arranged in the fourth through-hole.

8. The electric air pump as claimed in claim 6, wherein the piston is provided with a unidirectional sealing ring on an outer periphery thereof, wherein the cylinder member is further provided with a chamber extending along the second reference axis, and wherein the unidirectional sealing ring abuts against an inner surface of the chamber.

9. The electric air pump as claimed in claim 8, wherein the cylinder member is further provided with a threaded hole communicating with the chamber, wherein the connecting member is provided with a threaded portion formed on an outer periphery thereof and detachably engaging with the threaded hole, and a connecting hole extending along the second reference axis, and wherein the connecting member is further provided with an airtight member disposed in the connecting hole

and adapted for clamping the air valve.

10. The electric air pump as claimed in claim 1, wherein the first housing is further provided with an aperture, wherein the control circuit board has an activation control button exposed outside the first housing through the aperture.