



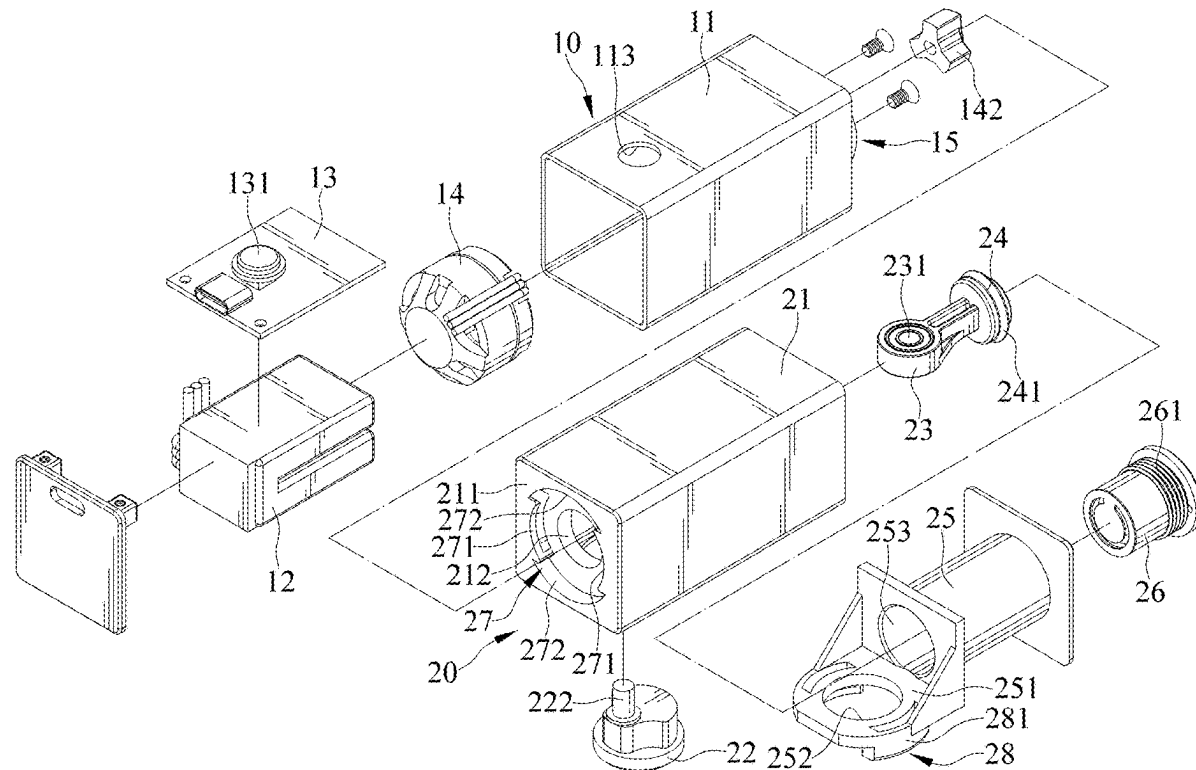
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(19) **United States**(12) **Patent Application Publication**
WU(10) **Pub. No.: US 2025/0257724 A1**(43) **Pub. Date: Aug. 14, 2025**(54) **ELECTRIC AIR PUMP**(71) Applicant: **Scott WU**, Taichung City (TW)(72) Inventor: **Scott WU**, Taichung City (TW)(21) Appl. No.: **19/191,458**(22) Filed: **Apr. 28, 2025****Related U.S. Application Data**(63) Continuation-in-part of application No. 18/346,401,
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(57)

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.



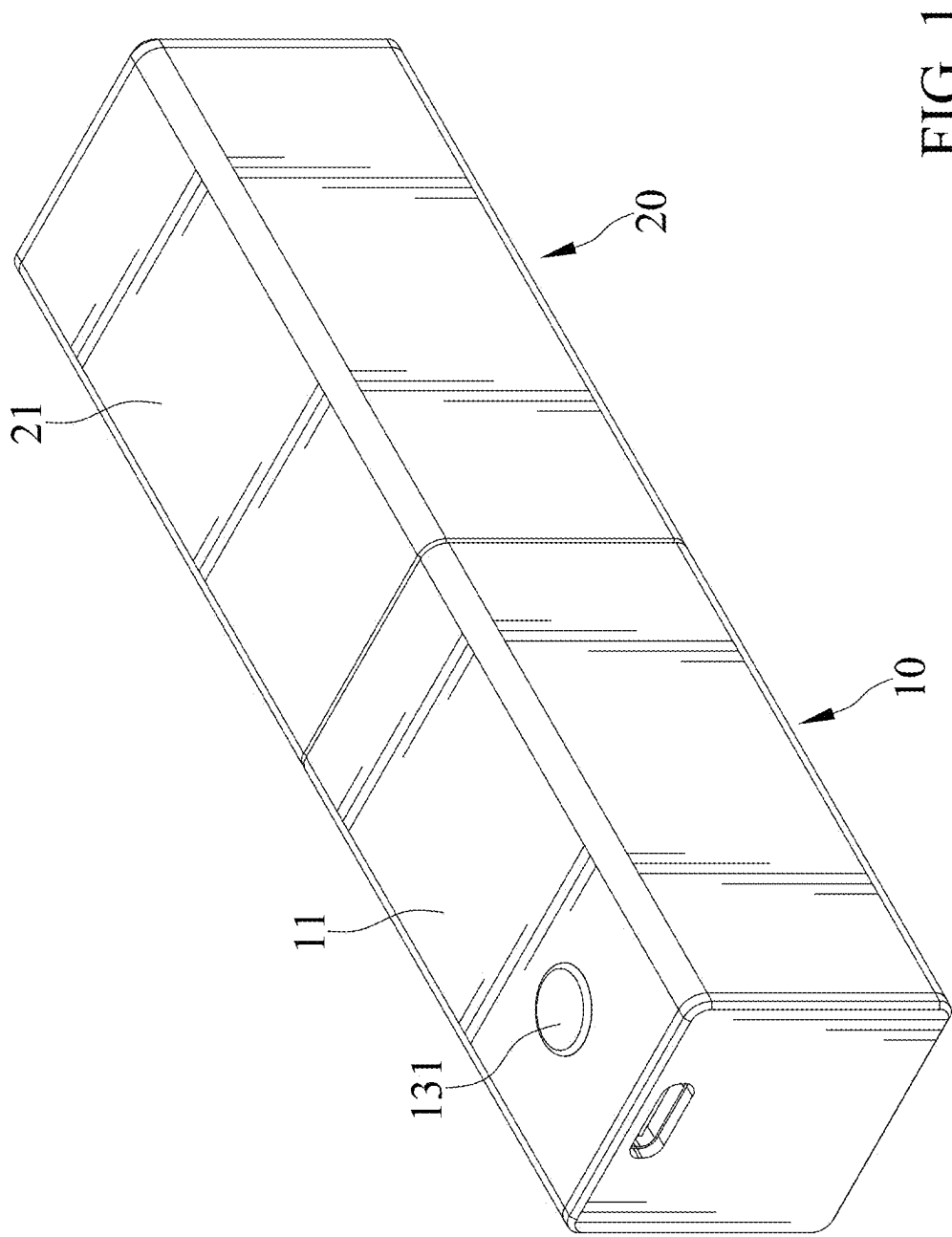


FIG. 1

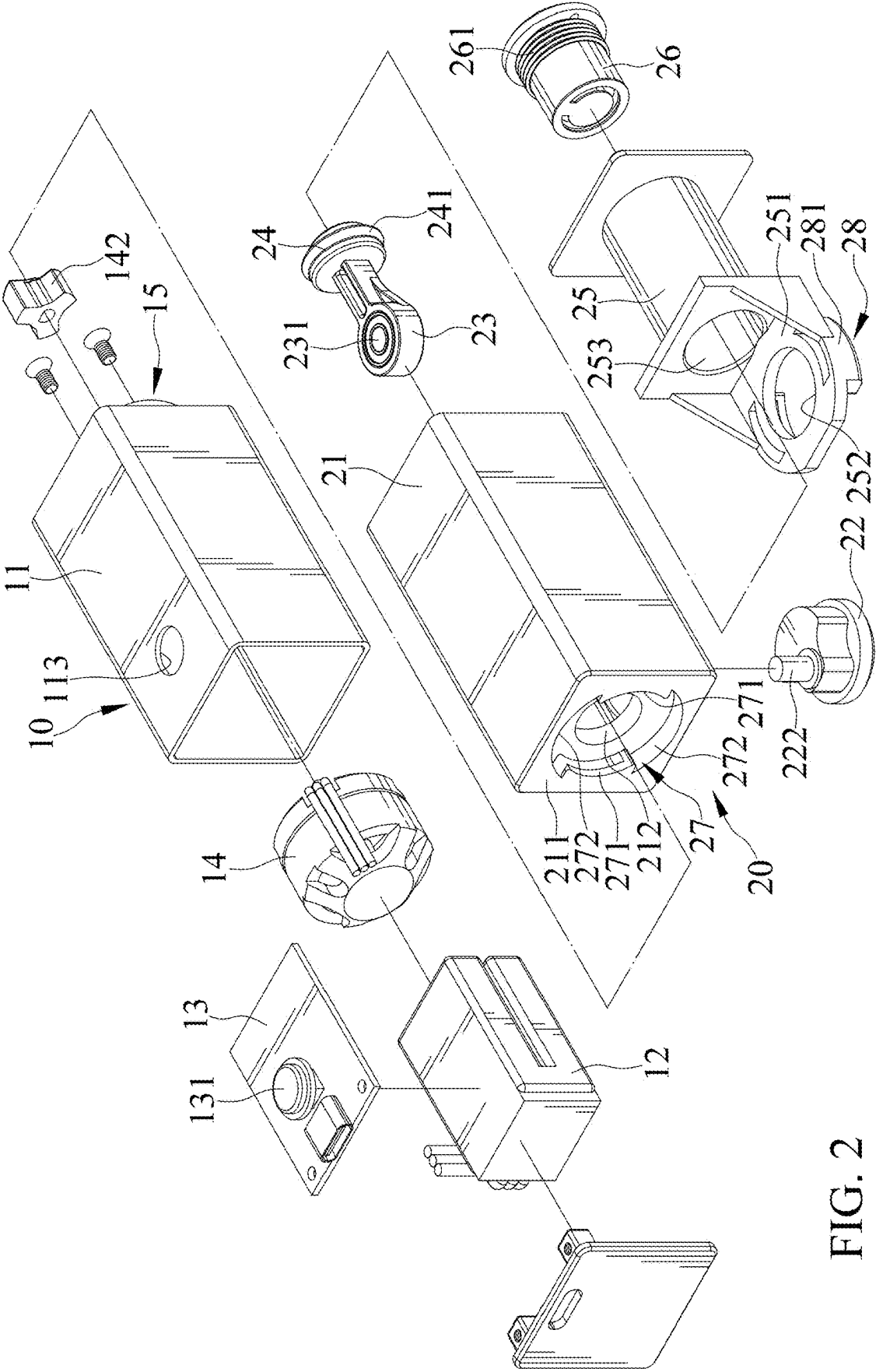


FIG. 2

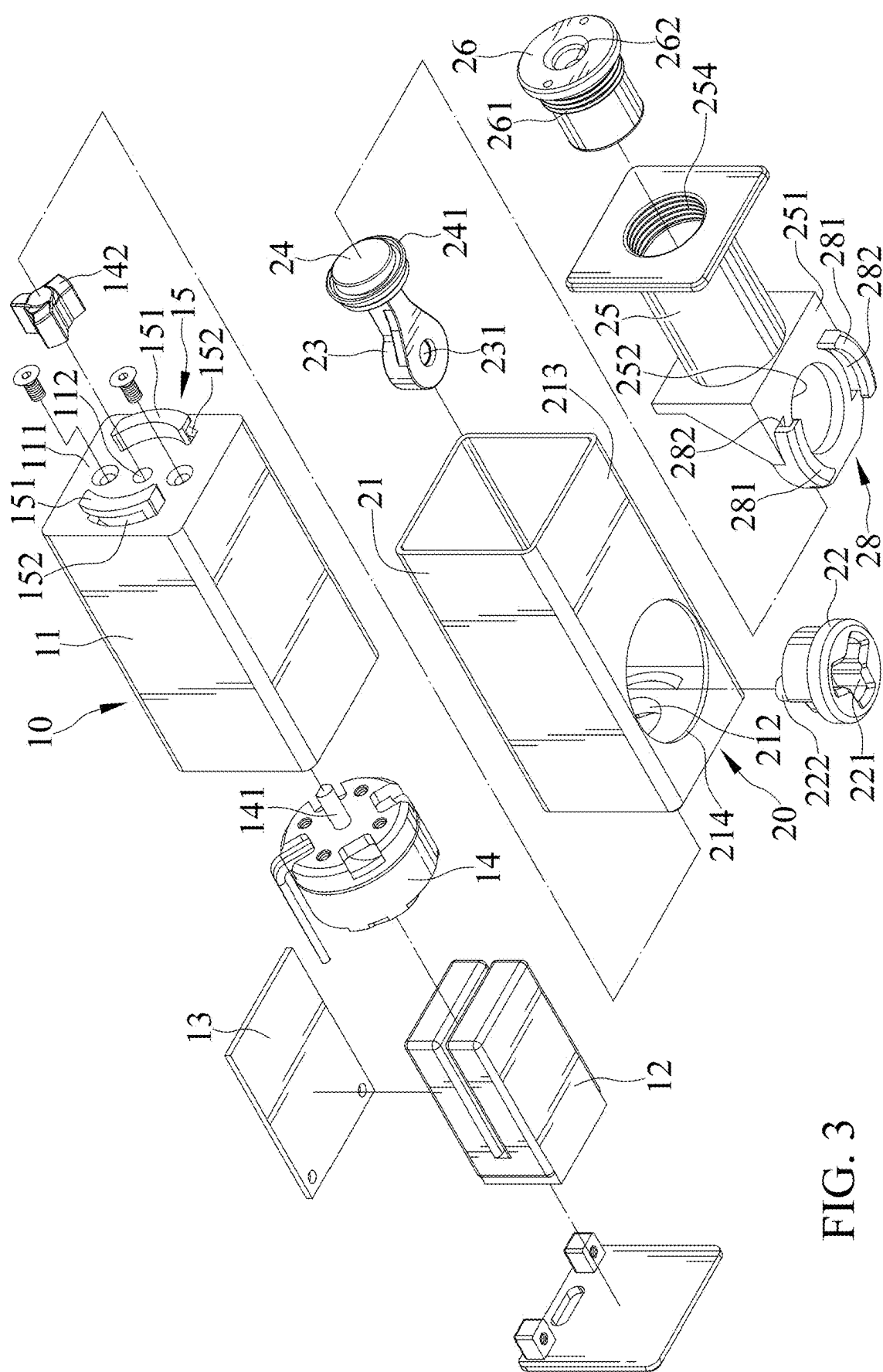


FIG. 3

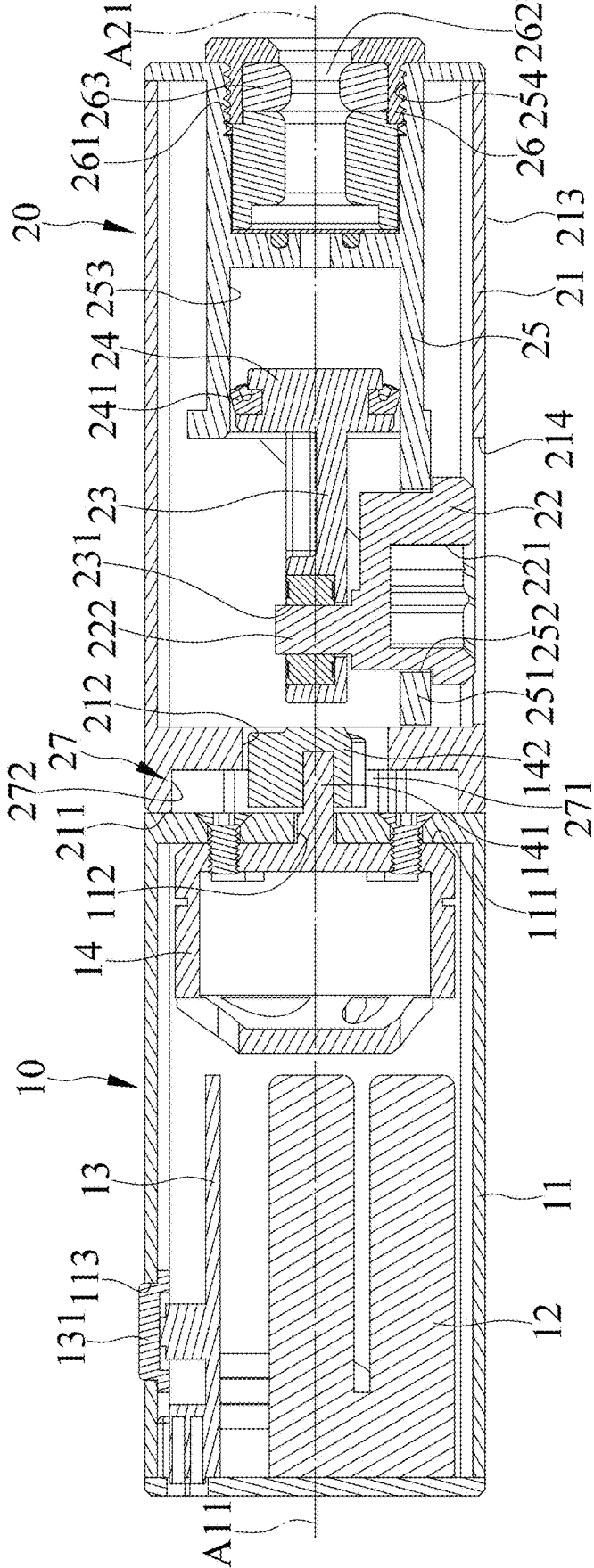


FIG. 4

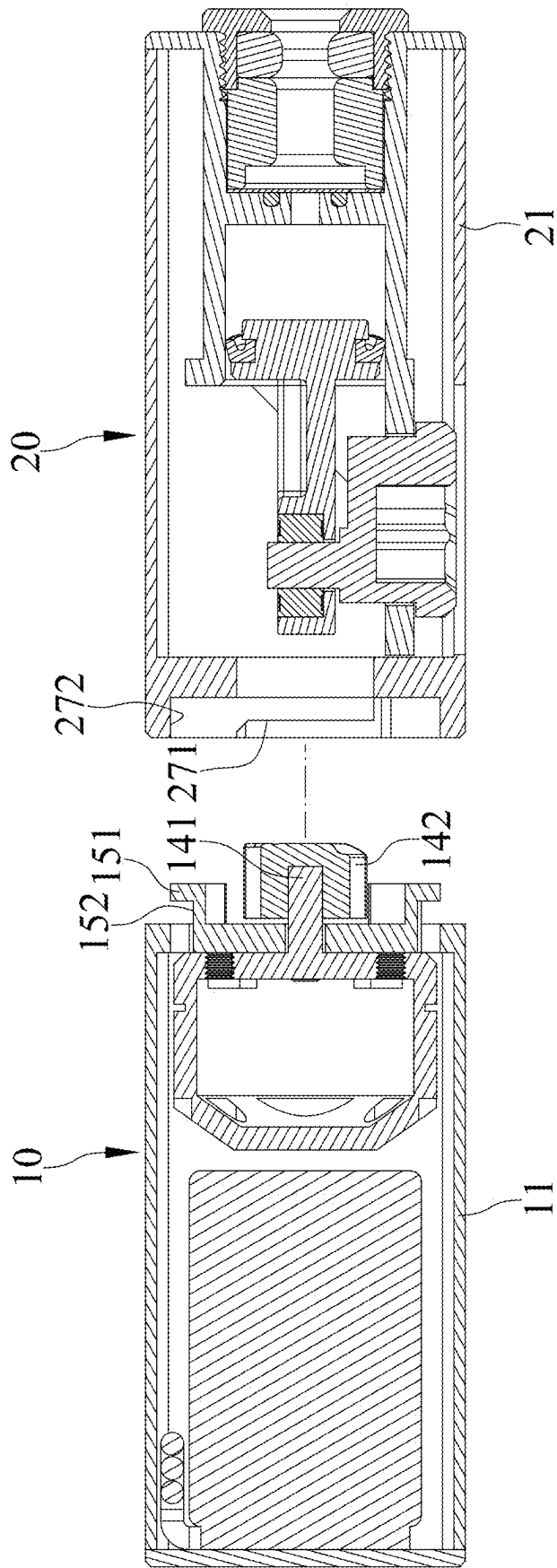


FIG. 5

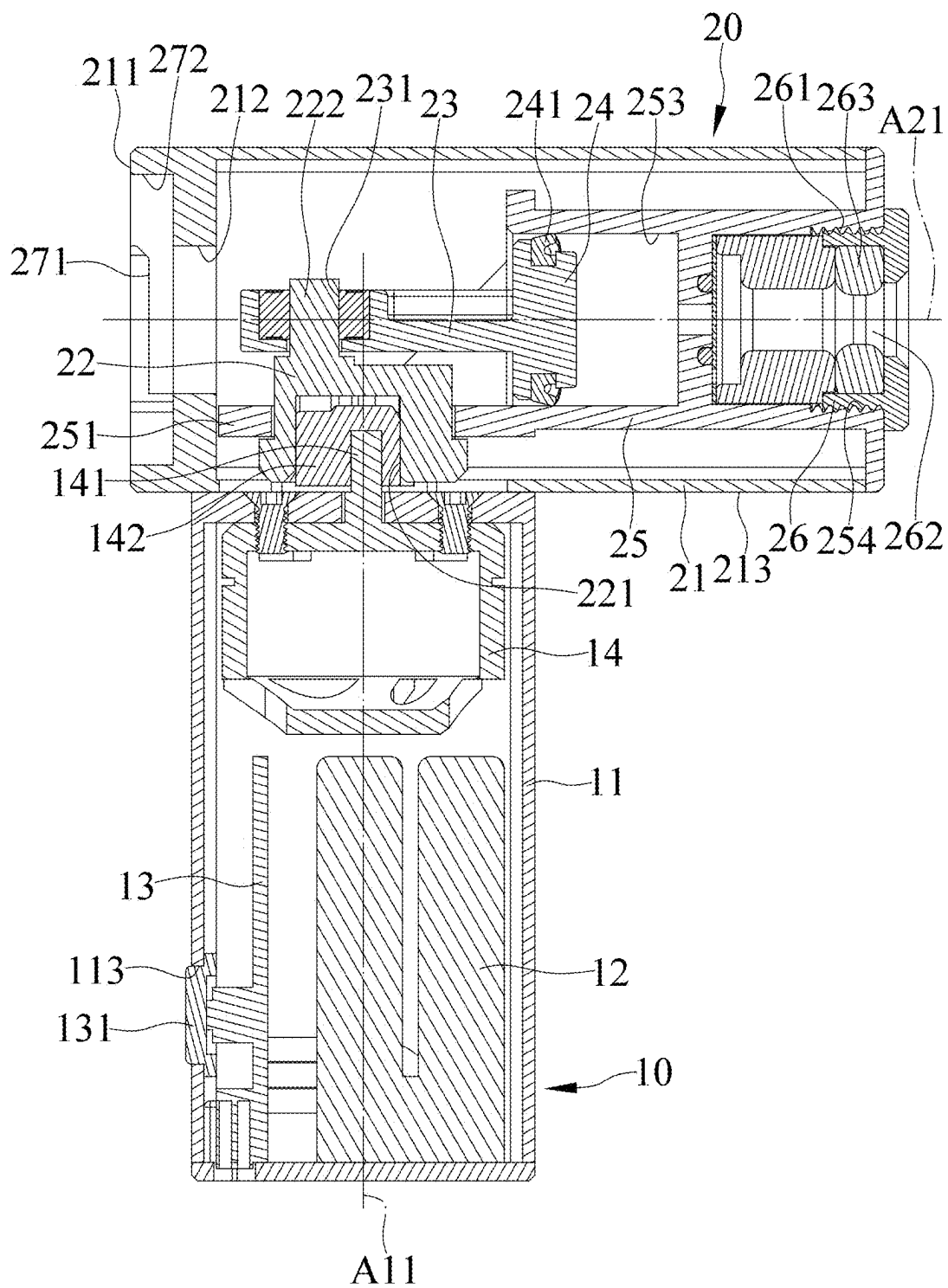


FIG. 6

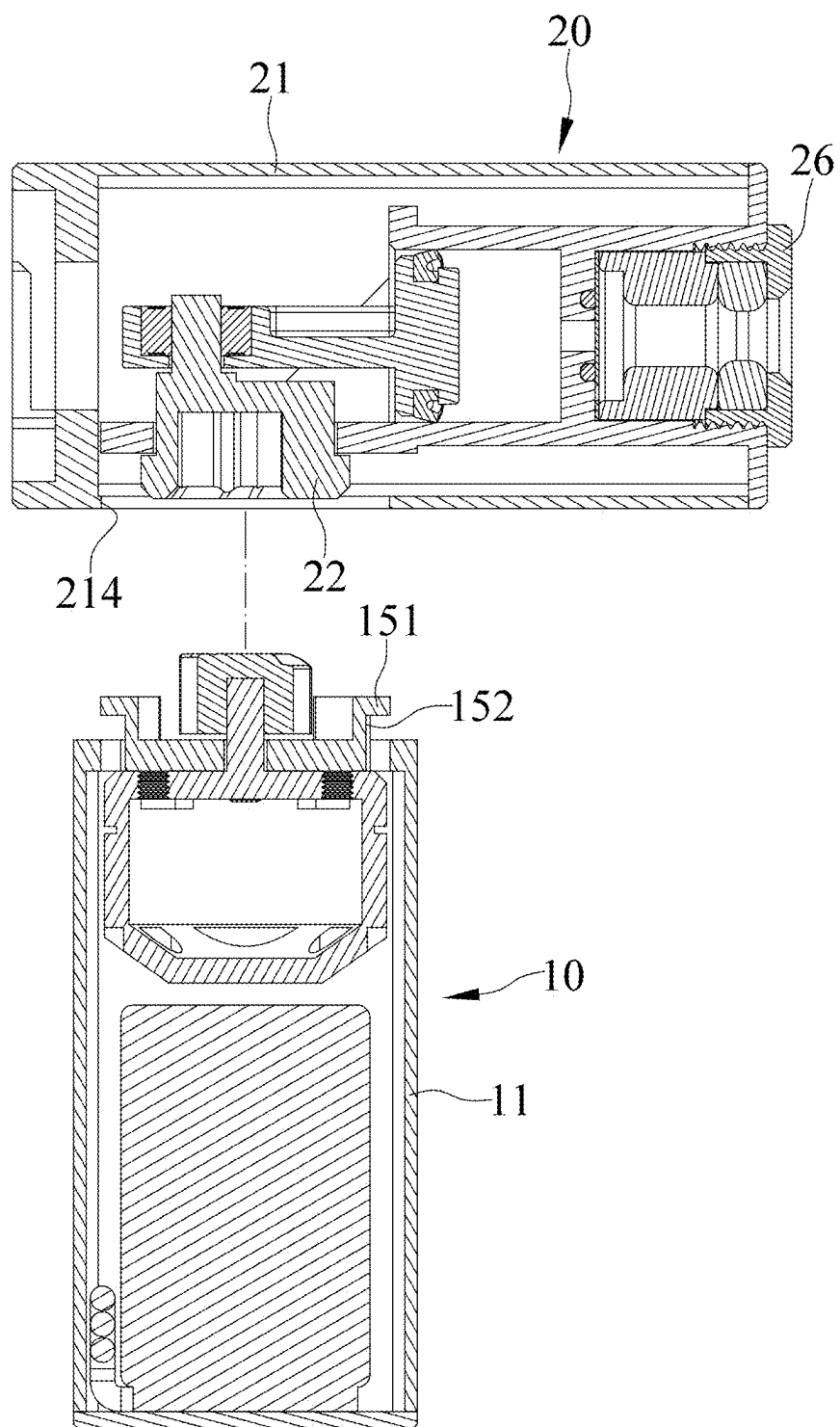


FIG. 7

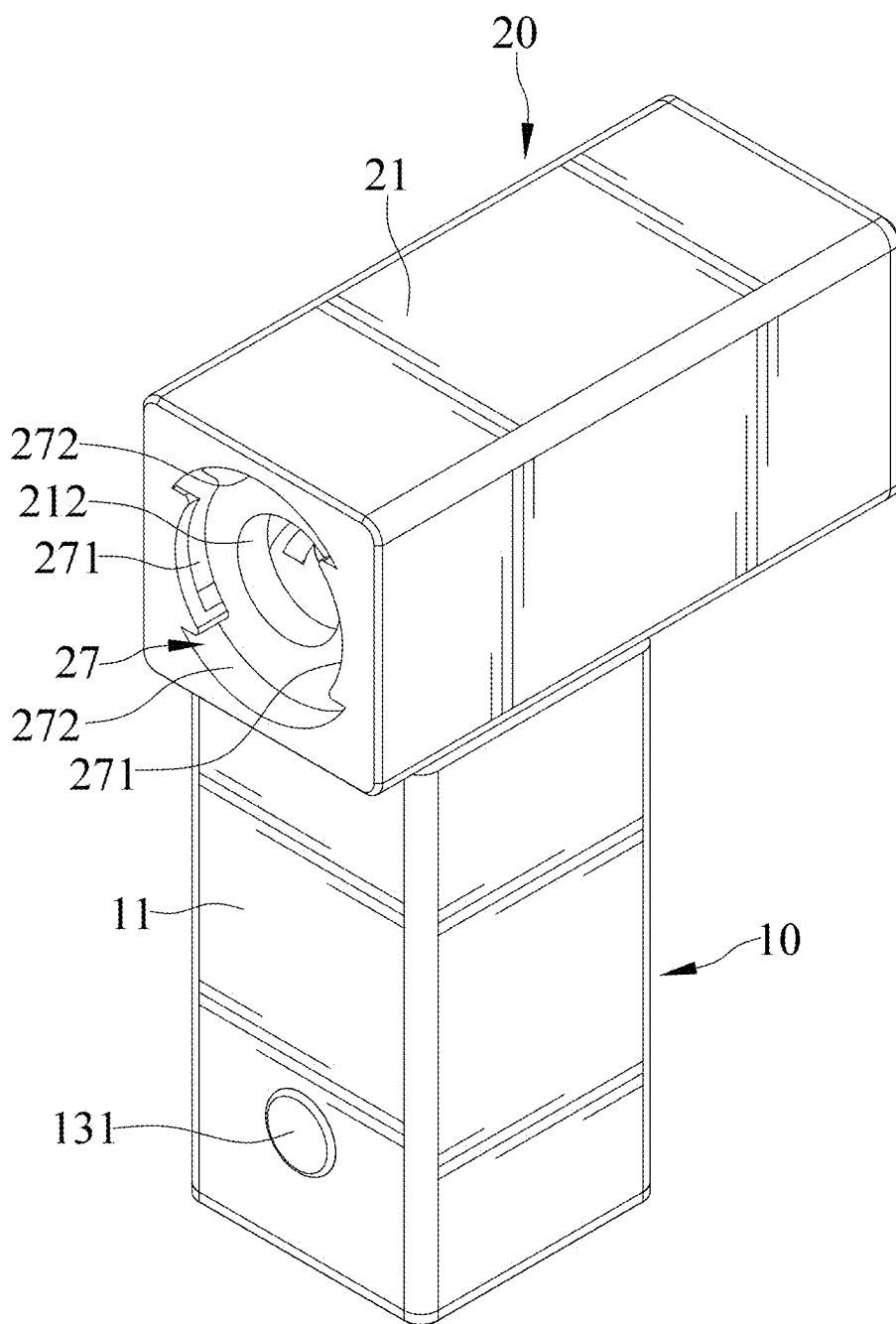


FIG. 8

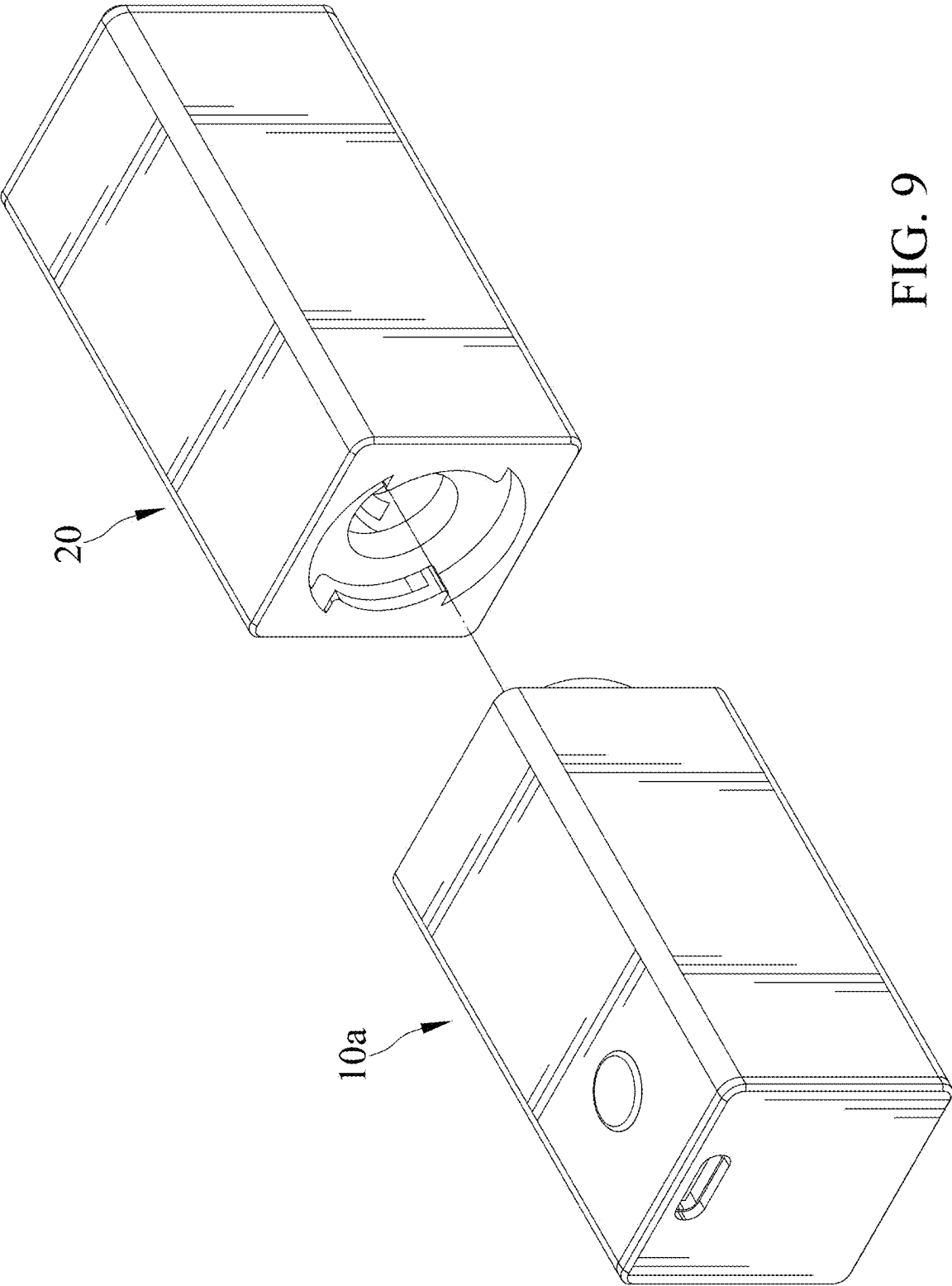


FIG. 9

ELECTRIC AIR PUMP

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.

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 A11, and the second housing 21 extends along a second reference axis A21. When the power unit 10 is in the first position, the first reference axis A11 is coaxial with the second reference axis A21 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 A11 intersects with the second reference axis A21 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 held 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 A11 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 A21, 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 A21. 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 A21. 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 A11 is coaxial with the second reference axis A21 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 A11 intersects with the second reference axis A21 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 10a (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.

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.

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