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(54) **AIR COMPRESSOR**

(57) An air compressor system. The system includes a frame configured to be supported on support surface defining a plane. An air storage tank, supported by the frame, has a center of gravity at a first height measured along a direction perpendicular to the plane. A power supply, removably coupled to the frame, has a center of gravity at a second height measured along a direction perpendicular to the plane. A motor, driven by the power supply, has a center of gravity at a third height measured along the direction perpendicular to the plane. An air pump, fluidly coupled to the tank and driven by the motor, has a center of gravity at a fourth height measured along the direction perpendicular to the plane. The first height and the second height may be less than the third height and the fourth height.

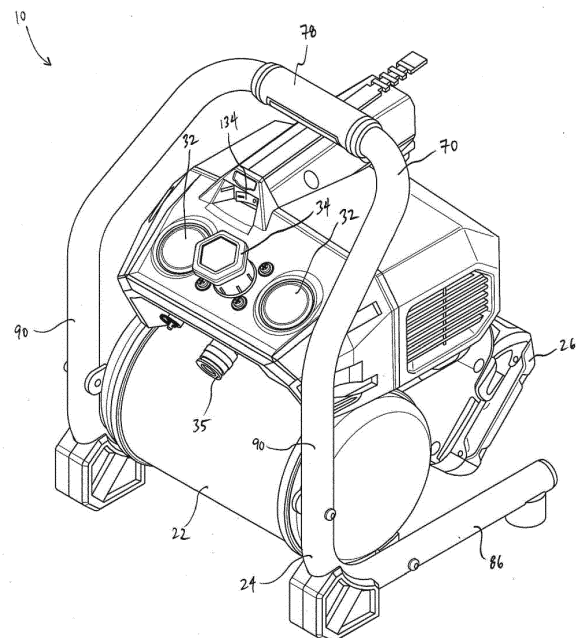


FIG. 1

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Description

RELATED APPLICATION

[0001] The present application is a continuation-in-part of and claims priority to U.S. Patent Application No. 15/584,854, filed May 2, 2017, the entire contents of which are hereby incorporated by reference.

FIELD

[0002] The present invention relates to air compressor systems and, more particularly, to the spatial arrangement of components for air compressor systems.

BACKGROUND

[0003] Air compressors include compressor units for compressing air and storage tanks for storing the compressed air for later use. Air compressors are often used at work sites, for example, to power pneumatically-operated tools. Existing air compressors are often large, heavy, bulky, and difficult to transport by hand.

SUMMARY

[0004] In one independent aspect, an air compressor system may generally include a frame configured to be supported on a support surface, the support surface defining a plane; an air storage tank supported by the frame, the tank having a center of gravity at a first height measured along a direction perpendicular to the plane; a power supply coupled to the frame, the power supply having a center of gravity at a second height measured along the direction perpendicular to the plane; a motor driven by the power supply, the motor having a center of gravity at a third height measured along the direction perpendicular to the plane; and an air pump driven by the motor and fluidly coupled to the air storage tank, the pump having a center of gravity at a fourth height measured along the direction perpendicular to the plane. The first height and the second height may be less than the third height and the fourth height.

[0005] The first height may be substantially the same as the second height.

[0006] The power supply may include a battery.

[0007] The battery may be a first removable battery.

[0008] The power supply may include a second removable battery.

[0009] The power supply may be disposed directly below the motor along the direction perpendicular to the plane.

[0010] The power supply may be disposed directly below the air pump along the direction perpendicular to the plane.

[0011] The tank may be spaced apart from the power supply along a direction parallel to the plane.

[0012] In another independent aspect, an air compres-

sor system, having a center of gravity, may generally include a frame configured to be supported on a support surface, the support surface defining a plane; an air storage tank supported by the frame; an air pump fluidly coupled to the tank; a power supply coupled to the frame, the power supply being disposed directly below the pump along a direction perpendicular to the plane; a motor driven by the power supply to operate the pump; and a handle coupled to the frame and including a grip portion, the grip portion being disposed directly above the center of gravity of the air compressor system along the direction perpendicular to the plane.

[0013] The power supply may include a battery.

[0014] The battery may be a first removable battery.

[0015] The power supply may include a second removable battery.

[0016] The power supply may include first and second removable batteries, wherein the first battery and the second battery may be moveable between an engaged position, in which the first battery and the second battery are coupled to the frame, and a disengaged position, in which the first battery and the second battery are removed from the frame, and wherein the grip portion is disposed directly above the center of gravity of system along the direction perpendicular to the plane when the first battery and the second battery are in the engaged position.

[0017] The first battery and the second battery may be in the disengaged position, the center of gravity of the system is moved along a direction parallel to the plane such that the center of gravity is no longer directly below the grip portion.

[0018] The power supply may be disposed directly below the motor along the direction perpendicular to the plane.

[0019] The tank may be spaced apart from the power supply along a direction parallel to the plane.

[0020] The system may further comprise a fitting in fluid communication with the tank to dispense compressed air.

[0021] The fitting may be above the center of gravity of the system.

[0022] In yet another independent aspect, an air compressor system, having a center of gravity, may generally include a frame configured to be supported on a support surface defining a plane; a power supply removably coupled to the frame and movable between an engaged position, in which the power supply is coupled to the frame, and a disengaged position, in which the power supply is removed from the frame; an air storage tank supported by the frame; an air pump fluidly coupled to the tank; a motor driven by the power supply to operate the pump; and a handle coupled to the frame and including a grip portion, the grip portion being disposed directly above the center of gravity of the system along a direction perpendicular to the plane when the power supply is in the engaged position, the center of gravity being moved along a direction parallel to the plane when the power supply is in the disengaged position.

[0023] In a further independent embodiment, an air compressor system having a center of gravity, may generally include a frame configured to be supported on a support surface defining a plane; a power supply removably coupled to the frame and movable between an engaged position, in which the power supply is coupled to the frame, and a disengaged position, in which the power supply is removed from the frame; an air storage tank supported by the frame; an air pump fluidly coupled to the tank; a motor driven by the power supply to operate the pump; and a handle coupled to the frame and including a grip portion, an axis being defined between the grip portion and the center of gravity of the system, the axis having a first orientation relative to the plane when the power supply is in the engaged position, the axis having a second orientation relative to the plane when the power supply is in the disengaged position, the grip portion being disposed directly above the center of gravity of the system along a direction perpendicular to the plane one of in the first orientation, in the second orientation and in between the first orientation and the second orientation.

[0024] The power supply may be disposed directly below the motor and the pump along the direction perpendicular to the plane.

[0025] The system may further comprise a fitting in fluid communication with the tank to dispense compressed air. The fitting may be above the center of gravity of the system.

[0026] The grip portion may be disposed directly above the center of gravity of the system along a direction perpendicular to the plane in the first orientation when the power supply is in the engaged position.

[0027] When the power supply is moved between the engaged position and the disengaged position, the center of gravity of the system may be moved relative to the grip portion along a direction parallel to the plane.

[0028] It will be appreciated that any of the optional features discussed above in relation to one aspect of the invention may, where appropriate, be applied to any of the other aspects of the invention.

[0029] Other independent aspects of the invention will become apparent by consideration of the detailed description, claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

FIG. 1 is a front perspective view of an air compressor system according to one embodiment of the invention.

FIG. 2 is a rear perspective view of the air compressor system of FIG. 1.

FIG. 3 is another rear perspective view of the air compressor system of FIG. 1.

FIG. 4 is a side plan view of the air compressor of FIG. 1, illustrating a pair of batteries coupled to the air compressor.

FIG. 5 is a side plan view of the air compressor of FIG. 1, illustrating the pair of batteries removed from the air compressor.

[0031] Before any independent embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other independent embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

DETAILED DESCRIPTION

[0032] FIGS. 1 and 2 illustrate an air compressor system 10 including a motor 14, an air pump 18, and an air storage tank 22 fixedly coupled together by a frame 24. The system 10 is supported on a support surface or ground surface 28 generally defining a plane. The motor 14 is powered by a DC power supply (e.g., one or more batteries 26 (two shown)), which are removably coupled to the frame 24. In other embodiments (not shown), the motor 14 may alternatively include an electrical cord that is selectively coupled to a power supply, e.g., an AC power supply (120 volts, 230 volts, etc.).

[0033] The motor 14 is driveably coupled to the pump 18 via a crank shaft 30 to pump ambient air into the tank 22. Air gauges 32 and a regulator knob 34 are fluidly coupled to the tank 22 to monitor and control air entering and exiting the tank 22. An outlet or fitting 35 provides fluid communication between at least one pneumatic tool (e.g., nailer, drill, etc.) and the tank 22 to operate the pneumatic tool.

[0034] With reference to FIGS. 2 and 3, the illustrated pump 18 includes a piston head (not shown) located within a cylinder 36 with the piston head being coupled to the crank shaft 30 by a piston rod 37. An air intake manifold 38 is coupled to a top portion of the cylinder 36 and includes an inlet 42 and an outlet 46. The inlet 42 is located fluidly between the ambient air and a compression chamber, which is defined by the cylinder 36, the piston head, and the manifold 38. The outlet 46 is located fluidly between the compression chamber and the tank 22. A check valve (not shown) is associated with the inlet 42 and the outlet 46 allowing air to flow in only one direction (e.g., into the tank 22).

[0035] With continued reference to FIGS. 2 and 3, a filter cap 58 and an air inlet control valve (not shown) are coupled to the air intake manifold 38 and is configured to regulate the ambient air entering the inlet 42. An inlet

conduit 62 is attached to a filter housing 66, which includes an air filter (not shown), by threadably engaging a portion of the filter housing 66 to the inlet conduit 62. The inlet conduit 62 is directly attached to the air intake manifold 38.

[0036] With reference to FIG. 4, the frame 24 of the system 10 includes a handle 70. Generally, the handle 70 is disposed directly above a center of gravity 74 of the system 10 to ensure there is no inadvertent swaying or tilting of the system 10 when the system 10 is lifted from the ground surface 28.

[0037] The handle 70 includes a grip portion 78 that an operator grasps for maneuvering the system 10. An axis 82, defined between the handle 70 and the center of gravity 74, is substantially perpendicular to the ground surface 28. The frame 24 further includes a base 86 adjacent the ground surface 28 and a pair of uprights 90 extending upward from the base 86 which, in turn, converge to define the handle 70 of the frame 24. In the illustrated construction, all of the components of the system 10 are substantially confined within the boundary defined by the base 86, the uprights 90, and the handle 70.

[0038] With respect to the system 10, the center of gravity 74 is found where the weighted relative positions of the various components (i.e., the motor 14, the pump 18, the tank 22, the batteries 26, etc.) sums to zero. The location of the center of gravity 74 is at least below the fitting 35 to ensure that the system 10 remains upright in case an operator applies a force on the fitting 35 during use.

[0039] The tank 22 has a center of gravity 94 at a first height 98 measured along a direction 102 that is perpendicular to the ground surface 28. In the illustrated embodiment, the first height 98 is approximately 102 millimeters to 108 millimeters above the ground surface 28. More specifically, the first height 98 is substantially 105 millimeters above the ground surface 28.

[0040] Also, the power source (and each battery 26) has a center of gravity 106 at a second height 110 relative to the ground surface 28 measured along the direction 102. In the illustrated embodiment, the second height 110 is approximately 90 millimeters to 98 millimeters above the ground surface 28. More specifically, the second height 110 is substantially 94 millimeters above the ground surface 28.

[0041] The motor 14 has a center of gravity 114 at a third height 118 relative to the ground surface 28 measured along the direction 102. In the illustrated embodiment, the third height 118 is approximately 210 millimeters to 220 millimeters above the ground surface 28. More specifically, the third height 118 is substantially 215 millimeters above the ground surface 28.

[0042] As for the pump 18, the pump 18 has center of gravity 122 at a fourth height 126 relative to the ground surface 28 measured along the direction 102. In the illustrated embodiment, the fourth height 126 is approximately the center of gravity of a motor bracket 127 be-

cause the motor bracket 127 weighs approximately six times more than the piston rod 37. The center of gravity of the motor bracket 127 is coincident with the axis of rotation of the motor 14. More specifically, a majority of the weight contributing to the center of gravity 122 of the pump 18 is from the motor bracket 127, a large pulley 129, and the air intake manifold 38. As such, the fourth height 126 is the sum of the center of gravity of the motor bracket 127, the large pulley 129, and the air intake manifold 38. As a result, the center of gravity 122 of the pump 18 is slightly below (relative to the ground surface 28) the axis of rotation of the motor 14. More specifically, the fourth height 126 is approximately 105 millimeters to 215 millimeters above the ground surface 28.

[0043] By summing the centers of gravity 94, 106, 114, 122 of the components 22, 26, 14, 18, the overall center of gravity 74 of the system 10 is substantially located. Although each component of the air compressor 10 has its own center of gravity that contributes to the overall center of gravity 74 of the system 10, only some of the component centers of gravity are described in further detail as these components (i.e., the motor 14, the pump 18, the tank 22, the batteries 26) have the greatest impact on the center of gravity 74.

[0044] With continued reference to FIG. 4, the first height 98 of the tank center of gravity 94 is substantially the same as the second height 110 of the power source center of gravity 106, such that the tank 22 and the batteries 26 are disposed at a similar height relative to the ground surface 28. Specifically, the center of gravity 94 of the storage tank 22 is disposed approximately 11 millimeters above the center of gravity 110 of the batteries 26. Accordingly, the first height 98 and the second height 114 are positioned closer to the ground surface 28 than the third height 118 and the fourth height 126.

[0045] As shown, the batteries 26 are disposed directly below the motor 14 and the pump 18 along the direction 102 that is perpendicular to the ground surface 28. Also, the tank 22 is spaced apart from the motor 14, the pump 18, and the batteries 26 along a direction 130 that is parallel to the ground surface 28. In other words, the motor 14, the pump 18, and the batteries 26 are located towards a rear of the system 10, whereas the tank 22 is located toward a front of the system 10.

[0046] With reference to FIGS. 4 and 5, the batteries 26 are selectively coupled to the frame 24 between an engaged position (FIG. 4), in which the batteries 26 are coupled to the frame 24 and operable to selectively supply power to the motor 14 via a power switch 134, and a disengaged position (FIG. 5), in which the batteries 26 are removed from the frame 26 (e.g., for charging and/or use to power another device). As shown in FIG. 5, the center of gravity 74 of the system 10 is moved along the direction 130 (e.g., forward of the axis 82 toward the front of the system 10) when the batteries 26 are in the disengaged position. As a result, the center of gravity 74 is no longer below the grip portion 78 of the handle 70.

[0047] The effect of engagement/disengagement of

the batteries 26 on the orientation of the grip portion 78 and the center of gravity 74 relative to the ground surface 28 depends on the size of the batteries 26. For lighter batteries 26 (i.e., with relatively fewer and/or smaller cells (e.g., an 18 volt battery 26 with a single set of cells (5 cells)), the effect is small and may not be perceptible to a user. For heavier batteries 26 (i.e., with relatively more and/or larger cells (e.g., an 18 volt battery 26 with three parallel-connected sets of cells (15 total cells)), the effect is greater.

[0048] The location of the handle 70 relative to the center of gravity 74 has a greater effect for a heavier system 10 compared to a lighter one. For a lighter system 10, the distance between the location of the handle 70 and a position directly above the center of gravity 74 may be greater before the effect is noticeable.

[0049] The location of the handle 70 relative to the center of gravity 74 also has a greater effect the greater the vertical distance between the handle 70 and the center of gravity 74. If the vertical distance is small, the distance between the location of the handle 70 and a position directly above the center of gravity 74 may be greater before the effect is noticeable.

[0050] Although the invention has been described in detail with reference to certain embodiments, variations and modifications exist within the scope and spirit of one or more independent aspects of the invention as described.

[0051] One or more independent advantages and/or independent features may be set forth in the claims.

Claims

1. An air compressor system comprising:

a frame configured to be supported on a support surface, the support surface defining a plane;
 an air storage tank supported by the frame, the tank having a center of gravity at a first height measured along a direction perpendicular to the plane;
 a power supply coupled to the frame, the power supply having a center of gravity at a second height measured along the direction perpendicular to the plane;
 a motor driven by the power supply, the motor having a center of gravity at a third height measured along the direction perpendicular to the plane; and
 an air pump driven by the motor and fluidly coupled to the air storage tank, the pump having a center of gravity at a fourth height measured along the direction perpendicular to the plane, wherein the first height and the second height are less than the third height and the fourth height.

2. The system of claim 1, wherein the first height is substantially the same as the second height.

3. The system of claim 1 or claim 2, wherein the power supply includes a battery; and optionally, wherein the battery is a first removable battery, and the power supply includes a second removable battery.

4. The system of claim any preceding claim, wherein the power supply is disposed directly below the motor along the direction perpendicular to the plane; AND/OR

the power supply is disposed directly below the air pump along the direction perpendicular to the plane.

5. The system of claim any preceding claim, wherein the tank is spaced apart from the power supply along a direction parallel to the plane.

6. An air compressor system having a center of gravity, the system comprising:

a frame configured to be supported on a support surface, the support surface defining a plane;
 an air storage tank supported by the frame;
 an air pump fluidly coupled to the tank;
 a power supply coupled to the frame, the power supply being disposed directly below the pump along a direction perpendicular to the plane;
 a motor driven by the power supply to operate the pump; and
 a handle coupled to the frame and including a grip portion, the grip portion being disposed directly above the center of gravity of the air compressor system along the direction perpendicular to the plane.

7. The system of claim 6, wherein the power supply includes a battery; and optionally, the battery is a first removable battery, and the power supply includes a second removable battery.

8. The system of claim 7, wherein the power supply includes first and second removable batteries, wherein the first battery and the second battery are moveable between an engaged position, in which the first battery and the second battery are coupled to the frame, and a disengaged position, in which the first battery and the second battery are removed from the frame, and wherein the grip portion is disposed directly above the center of gravity of system along the direction perpendicular to the plane when the first battery and the second battery are in the engaged position.

9. The system of claim 8, wherein, when the first battery

and the second battery are in the disengaged position, the center of gravity of the system is moved along a direction parallel to the plane such that the center of gravity is no longer directly below the grip portion.

10. The system of any of claims 6 to 9, wherein the power supply is disposed directly below the motor along the direction perpendicular to the plane;
AND/OR
the tank is spaced apart from the power supply along a direction parallel to the plane;
AND/OR
the system further comprising a fitting in fluid communication with the tank to dispense compressed air, the fitting being above the center of gravity of the system.
11. An air compressor system having a center of gravity, the system comprising:
- a frame configured to be supported on a support surface defining a plane;
 - a power supply removably coupled to the frame and movable between an engaged position, in which the power supply is coupled to the frame, and a disengaged position, in which the power supply is removed from the frame;
 - an air storage tank supported by the frame;
 - an air pump fluidly coupled to the tank;
 - a motor driven by the power supply to operate the pump; and
 - a handle coupled to the frame and including a grip portion, an axis being defined between the grip portion and the center of gravity of the system, the axis having a first orientation relative to the plane when the power supply is in the engaged position, the axis having a second orientation relative to the plane when the power supply is in the disengaged position, the grip portion being disposed directly above the center of gravity of the system along a direction perpendicular to the plane one of in the first orientation, in the second orientation and in between the first orientation and the second orientation.
12. The system of claim 11, wherein the power supply is disposed directly below the motor and the pump along the direction perpendicular to the plane.
13. The system of claim 11 or claim 12, further comprising a fitting in fluid communication with the tank to dispense compressed air, the fitting being above the center of gravity of the system.
14. The system of any of claims 11 to 13, wherein the grip portion is disposed directly above the center of gravity of the system along a direction perpendicular

to the plane in the first orientation when the power supply is in the engaged position.

15. The system of any of claims 11 to 14, wherein, when the power supply is moved between the engaged position and the disengaged position, the center of gravity of the system is moved relative to the grip portion along a direction parallel to the plane.

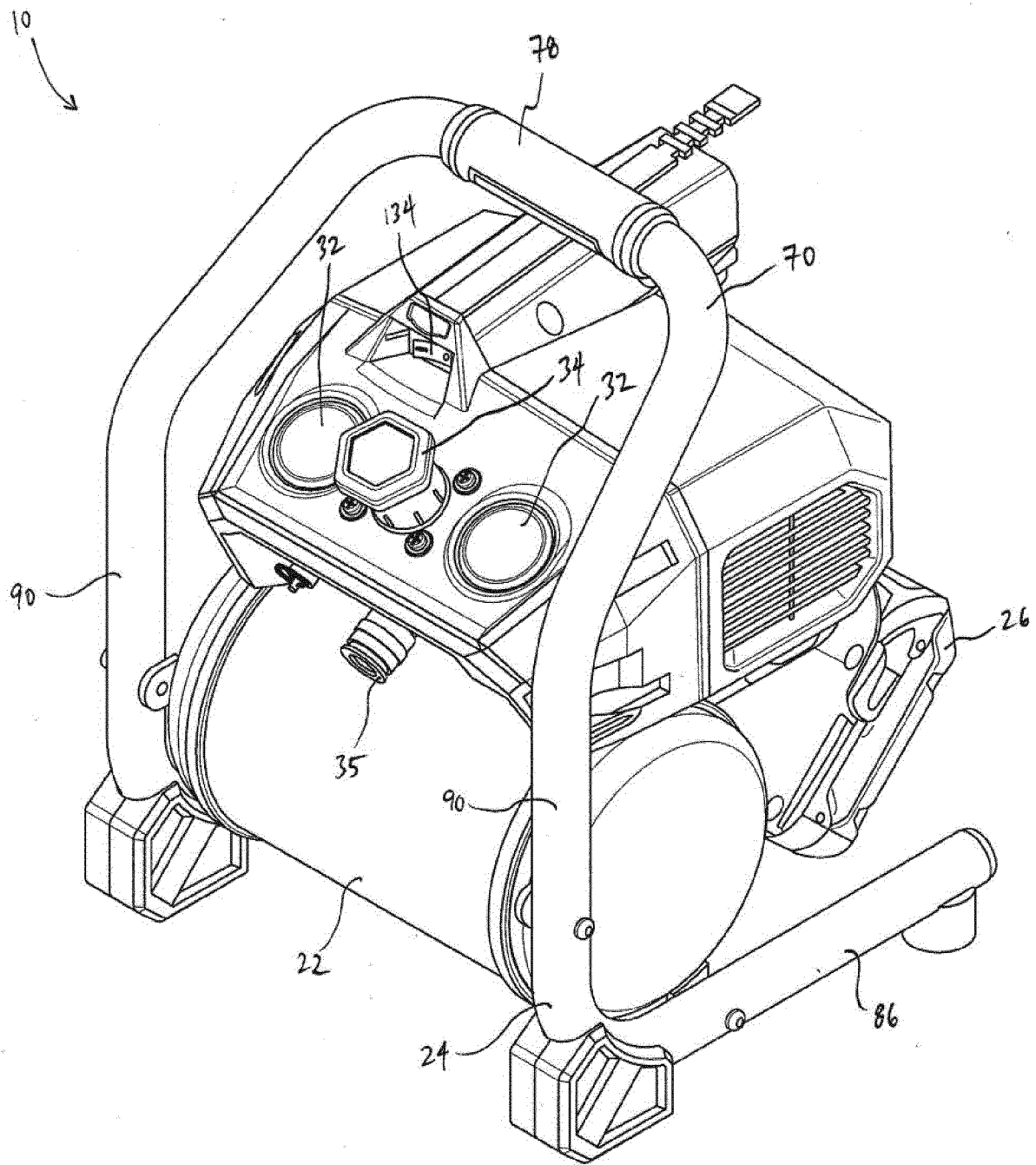


FIG. 1

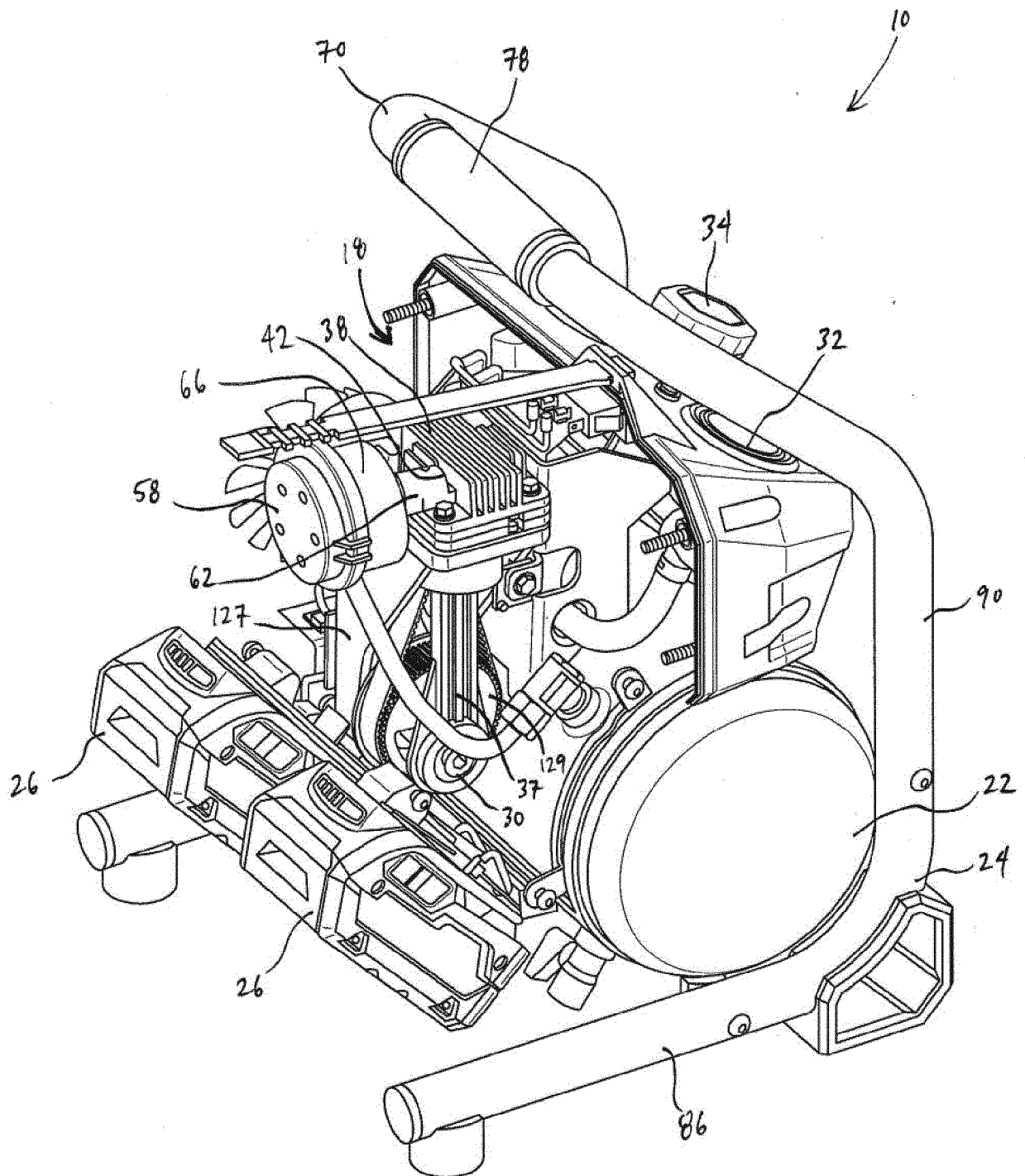


FIG. 2

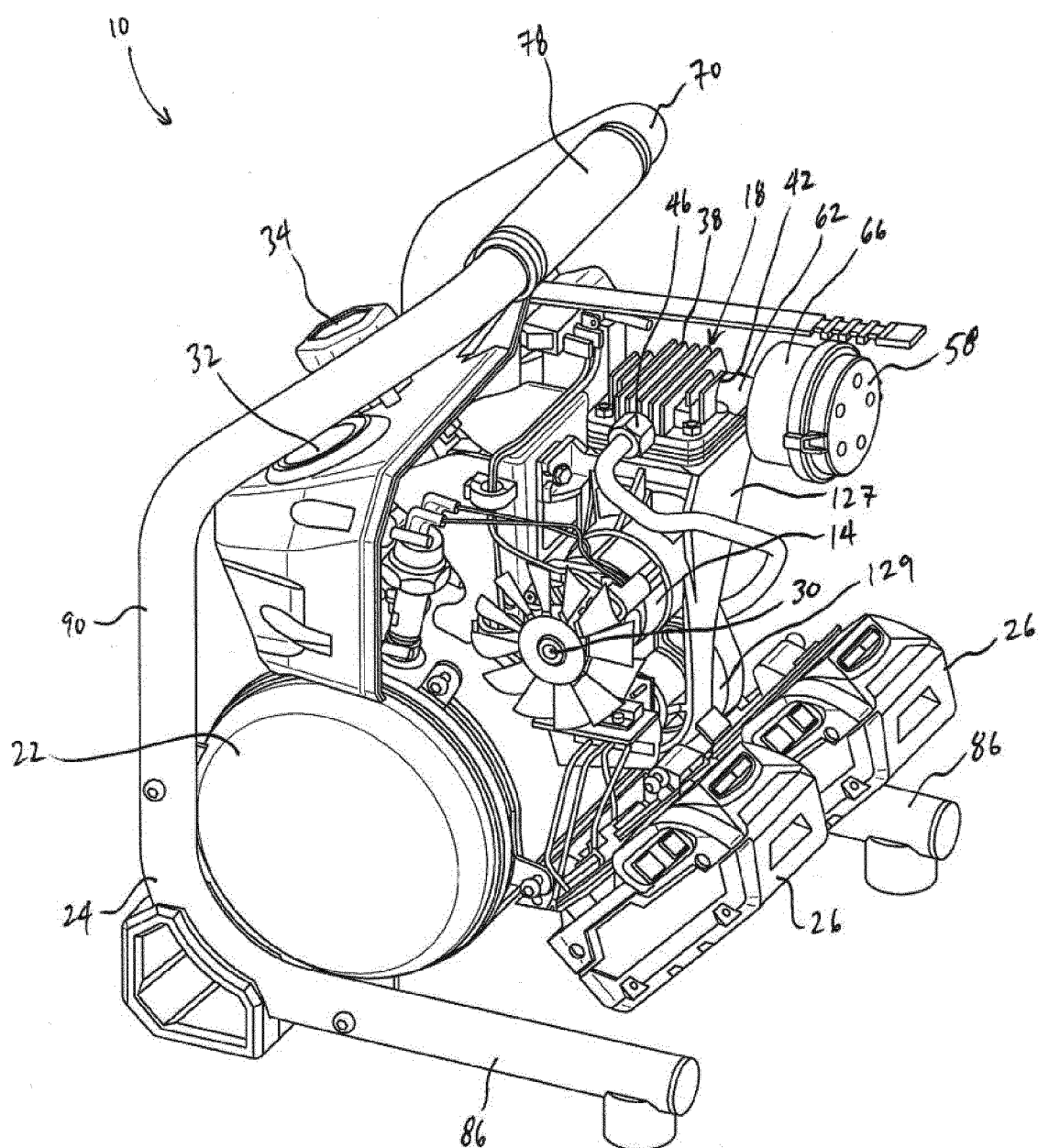
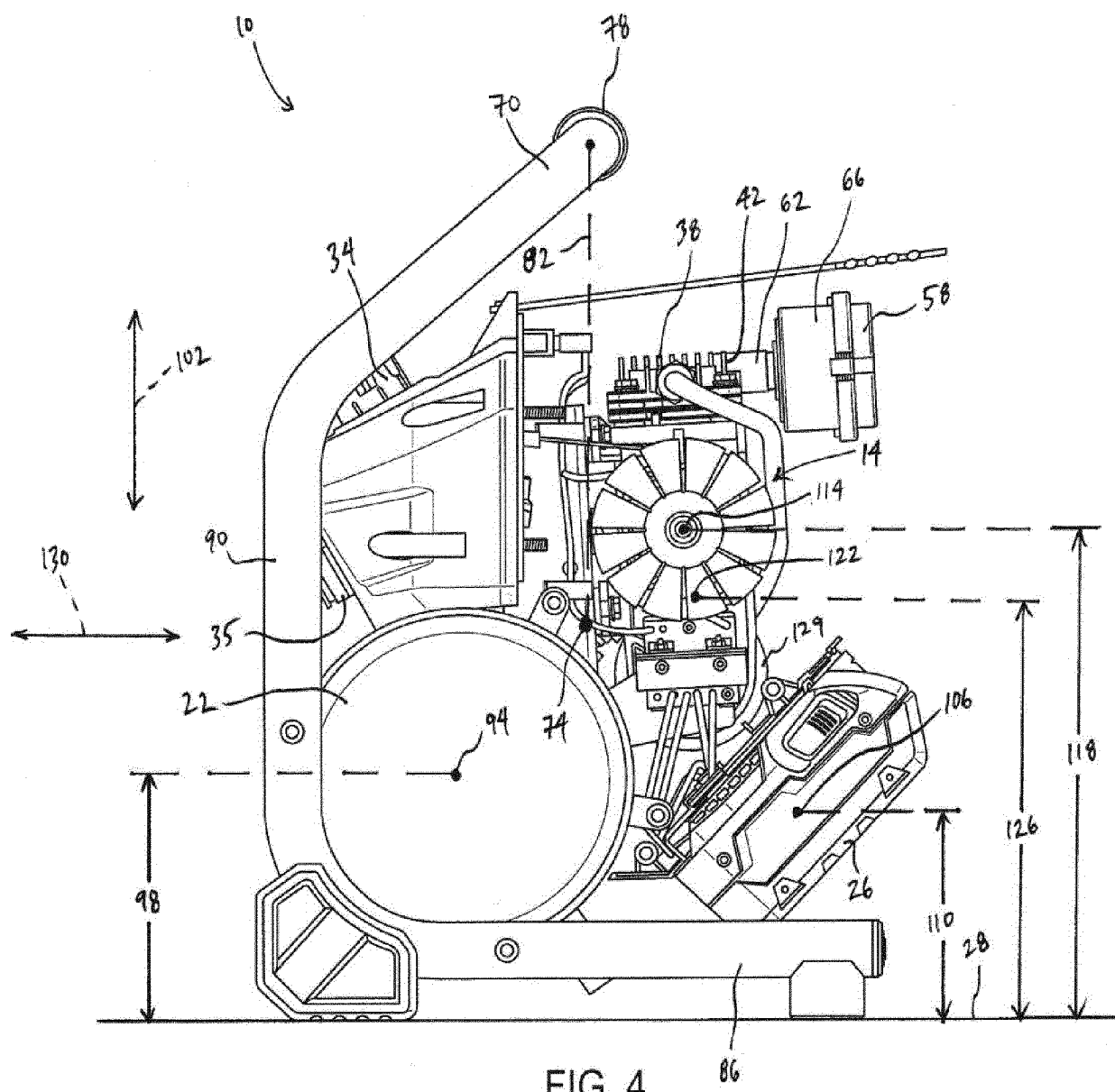
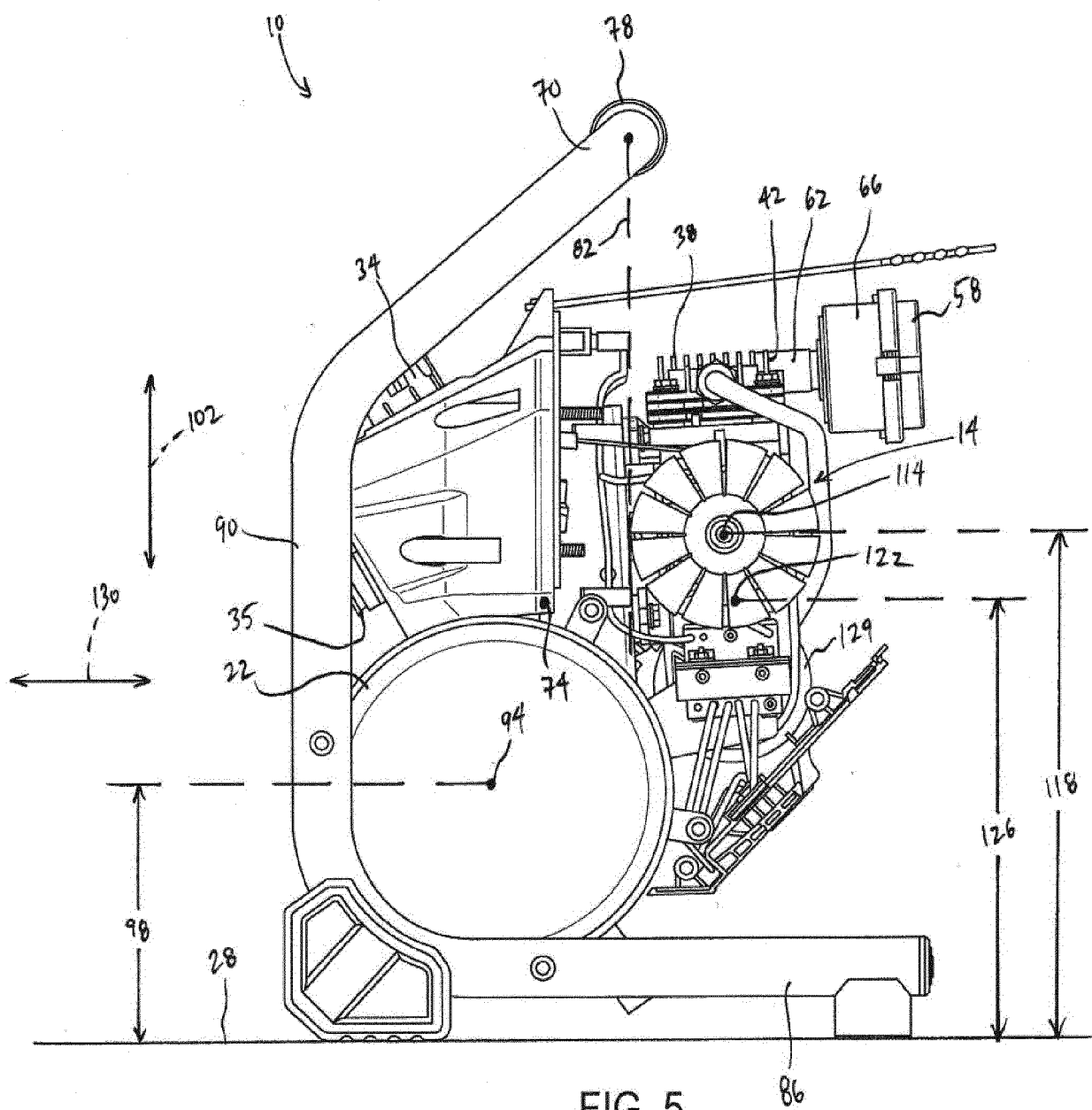


FIG. 3





REFERENCES CITED IN THE DESCRIPTION

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