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(54) Pressure washer with an internal combustion motor pump

(57) A fuel powered machine has an engine (40) with an output shaft (41) that extends substantially downward from the engine (40), the output shaft (41) being rotationally connected with a working member that is located substantially below the engine, with a frame (60) rigidly supporting the engine and the working member and all enclosed within an internal volume formed by a housing that includes at least one panel (50) that is mounted to the frame (60). The panel (50) includes at least one aperture (56) that is suitable for air flow through the apertures and past the engine and the working member. Operational controls (46) are positioned on one of the plurality of panels (50) for controlling the operation of the fuel powered machine, and an output connector provided through one of the plurality of panels (50).

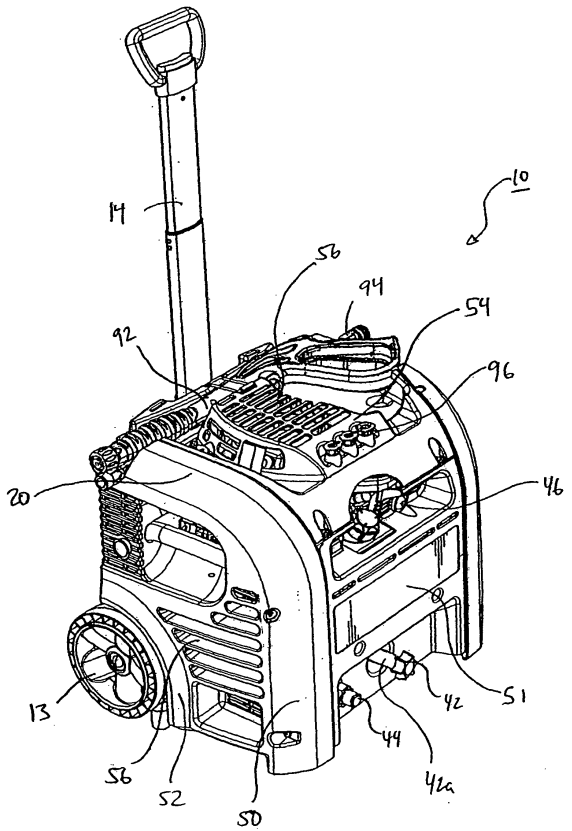

FIG. 1

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Description

[0001] The present invention relates to portable machines with fuel powered engines, and specifically to portable pressure washers, generators, or air compressors with fuel powered engines.

[0002] Specifically, many portable fuel powered machines include engines that are exposed and create potential burn hazards if the exposed engine is contacted during extended operations of the unit. Additionally, many fuel powered machines are formed with the mechanical components used in operating the machine, such as the engine, the pump, and associated piping exposed to the user. This often produces a machine that is visually unappealing and appears to a novice or untrained user to be more complicated to operate than it actually is. Accordingly, it is desired to provide a portable fuel powered machine that overcomes the deficiencies discussed above, especially a unit that is substantially enclosed to reduce any burn injuries during operation and has an uncomplicated aesthetic appearance.

[0003] The present invention includes a fuel powered machine that includes a fuel powered engine with an output shaft that rotates during engine operation and extends substantially downward from the engine. The output shaft is rotationally connected with a working member that is located substantially below the engine. A frame rigidly supports the engine and the working member. At least one and, desirably a plurality of panels are mounted to the frame to substantially enclose the engine and the working member. The panels may include at least one aperture and may include a plurality of apertures that are suitable for air flow through the apertures and past the engine and the working member. Operational controls may be positioned on one of the panels for controlling the operation of the fuel powered machine, and an output connector may be provided through one of the plurality of panels.

[0004] Advantages of the present invention will become more apparent to those skilled in the art from the following description of the preferred embodiments of the invention that have been shown and described by way of illustration. As will be realized, the invention is capable of other and different embodiments, and its details are capable of modification in various respects. Accordingly, the drawings and description are to be regarded as illustrative in nature and not as restrictive.

[0005] More particularly, in a first aspect the invention provides a pressure washer comprising (a) a fuel powered engine including an output shaft that rotates with engine operation and extending substantially downward from the engine; (b) a working member rotatably coupled to the output shaft and located substantially below the engine; (c) a frame rigidly supporting the engine and the working member; (d) a plurality of panels mounted to the frame to substantially enclose the engine and the working member; (e) a plurality of apertures formed in the plurality of panels suitable for air flow through the apertures and past the engine and the working member; (f) operational controls positioned on the plurality of panels for controlling the operation of the fuel powered machine; and (g) an outlet connector provided through one of the plurality of panels.

[0006] The operational controls and the outlet connector are provided on a front panel of the plurality of panels.

[0007] In one embodiment working member is a positive displacement pump.

[0008] In a preferred embodiment an inlet connector is located on the same one of the plurality of panels as the outlet connector and in the vicinity of the outlet connector, with the inlet and outlet connectors positioned on a front panel of the plurality of panels, more specifically, the operational controls are positioned on the front panel and the inlet and outlet connectors are located below the operational controls on the front panel.

[0009] A plurality of baffles may be connected with one of the engine or the frame for directing air flow through the substantially enclosed engine.

[0010] A base plate may be provided connected to the frame and rigidly supporting both the fuel powered engine and the working member on opposite sides of the base plate.

[0011] In a further aspect the invention resides in a pressure washer comprising (a) an engine with an output shaft extending substantially vertically below the engine; (b) a pump operationally connected to the output shaft; (c) a frame supporting both the engine and the pump; (d) a plurality of panels mounted to the frame to substantially enclose the engine and the pump; (e) a plurality of apertures formed in the plurality of panels suitable for air to flow through the apertures for engine and pump cooling and for use with the combustion cycle of the engine; (f) an output connector provided on one of the plurality of panels; and (g) an inlet connector provided on one of the plurality of panels.

[0012] The inlet connector and output connector are each positioned below the operational controls and substantially in-line with the pump.

[0013] The plurality of panels preferably substantially enclose the front side, the back side, the right side, the left side, and the top of the engine and the pump, and do not contact the engine or pump.

[0014] The left and right panels each include a slot extending from a rear edge of each of the left and right panels, and the plurality of panels further comprises a rear panel with fins that extend from a left side and a right side of the rear panel, wherein the fins are slidably mounted within the slots on each of the left and right panels to connect the rear panel to the left and right panels.

[0015] The features and advantages of the present invention may be better understood by reference to the accompanying drawings in which like reference numerals refer to like elements.

FIG. 1 is a perspective view of one embodiment of a pressure washer of the present invention.

FIG. 2 is a front view of the pressure washer of FIG. 1.
FIG. 3 is right side view of the pressure washer of FIG. 1.
FIG. 4 is a back view of the pressure washer of FIG. 1.
FIG. 5 is a top view of the pressure washer of FIG. 1.
FIG. 6 is a bottom view of the pressure washer of FIG. 1.
FIG. 7 is an exploded view of the pressure washer of Fig. 1.
FIG. 8 is a side view of the pressure washer showing the engine and the pump with the panels removed.
FIG. 9 is the side view of FIG. 8 showing only the engine.
FIG. 10 is a front view of the pressure washer showing the engine and the pump with the panels removed.
FIG. 11 is a top view of the pressure washer showing the engine with the panels removed.

[0016] While this invention is susceptible of several different embodiments, this specification and the accompanying drawings disclose only some specific forms as examples of the invention. The invention is not intended to be limited by the descriptions in this specification or the drawings. Instead, the scope of the invention is provided in the claims.

[0017] The disclosure herein can be implemented with a multitude of different types of machines that include engines to operate a working member to perform a specific task. Additionally, the concept disclosed herein may be implemented on various machines that include fuel powered engines, such as pressure washers, generators, or air compressors. Although the invention may be implemented with a variety of different types of machines, the design is fully described with specific references to use in a pressure washer. For the sake of brevity we do not fully describe the use of this concept with other types of machines although one of skill in the art, after fully reviewing the specification and drawings herein, will comprehend that this disclosure may successfully be implemented with other types of machines.

[0018] Turning now to FIG. 1, a pressure washer 10 is provided. The pressure washer 10 is used to receive liquid at a relatively low pressure through an inlet port 42 and to raise the pressure using a pump 48, or similar device, until the liquid pressure is such that the liquid may be projected through a hose attached to an outlet port 42b and subsequently through a spray gun 92 and a lance 94, or similar device, at a high rate of speed and pressure. The liquid projected from the pressure washer 10 may be used for various operations or tasks. Often, pressure washers are located on a wheeled cart or other movable apparatus to allow the pressure washer to be transported to remote locations for use. The pump 48 on a pressure washer may be a positive displacement pump, such as an axial cam pump with a wobble plate (not shown) and a plurality of axial pistons (not shown) that translate linearly within the pump 48 based on the position of the wobble plate. The engine 40 includes a rotatable output shaft 41 that is coupled with the wobble plate provided within the pump 48. In some embodiments, the fuel powered engine 40 may be an internal combustion engine.

[0019] The engine 40 is mounted to an upper surface of a base plate 66 that is welded to the frame 60. In other embodiments, the base plate 66 can be rigidly mounted to the frame with a plurality of fasteners. The base plate 66 includes an inner aperture (not shown) that allows the output shaft 41 of the engine 40 to extend vertically below the engine 40 and through the base plate 66. The pump 48 is mounted to the opposite side of the base plate 66. Accordingly, the base plate 66 is sandwiched between the engine 40 and the pump 48 and the two components are mounted to the base plate 66 with a plurality of fasteners (not shown). Accordingly, the base plate 66 both provides a structure for mounting the engine 40 and the pump 48 to the frame 60, but also provides a structure for aligning these two components together and with respect to the frame 60.

[0020] As mentioned above, the pump 48 receives the output shaft 41 of the engine 40 within a female receptacle (not shown) within the pump 48 and the output shaft 41 is rotatably connected to the wobble plate. As known to those of ordinary skill in the art, the wobble plate is connected to the output shaft 41 at an oblique angle to the output shaft 41. In other embodiments, the pump 48 may include a receiver shaft (not shown) that is rotatably connected to the wobble plate. The receiver shaft and the engine output shaft 41 are engaged to transfer the torque from the engine to the wobble plate. Accordingly, the wobble plate forms a first side that extends obliquely downward and away from the base plate 66 and a second opposite side that extends obliquely upward toward the base plate 66.

[0021] The pump 48 additionally includes a plurality of pistons (not shown) that are translatable within their respective cylinders (not shown) based on the rotation of the wobble plate. Each of the pistons are biased upward within their cylinder and away from the cylinder outlet and are translated downward toward the cylinder outlet end when the downward side of the wobble plate engages the top surface of the piston. As understood by those of ordinary skill in the art, as the wobble plate rotates one full revolution, each of the pistons translates linearly through their respective cylinder one full cycle. When each piston translates upward through their cylinder and away from the output end of the cylinder, a volume of liquid is provided within the cylinder between the output port of the cylinder and the piston.

[0022] As the piston is moved toward the output port by the wobble plate, the volume within the cylinder that contains the liquid is reduced causing the liquid pressure within the cylinder to increase. Eventually, the liquid pressure is sufficient to overcome the pressure holding a check valve (not shown) located just downstream of the outlet portion and the volume of liquid (now at an increased pressure) flows through the check valve and into

the output pipe 44a. The liquid that flows through outlet pipe 44a flows through the outlet port 44 for use by the operator.

[0023] In other embodiments, the pump may be a radial piston pump that can be operatively engaged to the vertically mounted engine output shaft 41 to raise the pressure of a supply of liquid. Additionally, the pump may be a centrifugal pump with an impeller for raising the pressure of a supply of liquid (not shown) operatively engaged to the engine output 41. In still other embodiments, the pump may be a plunger/crankshaft drive pump that is operatively engaged to the engine output shaft 41.

[0024] As shown in the figures, the inlet and outlet ports 42, 44 may be positioned in close proximity to each other and may extend through one of the panels 50 that forms the external surface of the pressure washer. The geometry and the formation of the panels 50 are discussed in detail below.

[0025] The vertical mounting arrangement of the pump 48 in which it is located below the engine 40 allows for a relatively compact design. In addition, such an arrangement minimizes the length that the inlet pipe 42a and outlet pipe 44a are required to extend between the pump 48 and the external surface of the pressure washer. Shorter pipe runs are desired to minimize the pressure drop through the inlet and outlet pipes 42a, 44a. It is beneficial to minimize the outlet pressure drop to maximize the liquid pressure for use at the job site. Minimizing the length of the inlet and outlet pipes 42a, 44a also minimizes the cost and weight of the machine 10.

[0026] As discussed above, and as best shown in FIGs. 1 and 7, a housing 20 is formed on the exterior of the pressure washer 10 from at least one and generally from a plurality of panels 50 that are operatively engaged with the frame 60, the base plate 66, and other neighboring panels 50. Specifically in the depicted embodiment, the pressure washer 10 includes a front panel 51, left and right panels 52, 53, a top panel 54, and a rear panel 55. The bottom of the pressure washer 10 normally does not include a protective panel. In other embodiments, the bottom may be enclosed with a panel as well.

[0027] As shown in FIG. 7, the left and right panels 52, 53 are each connected to the frame 60 with a plurality of fasteners 70. The top panel 54 is connected to the frame and the left and right panels 52, 53 with another plurality of fasteners 70. The front panel 51 is attached to the top panel 54 and to the base plate 66. Finally, the rear panel 55 includes a fin 55a on each of the left and right sides of the rear panel 55 that each slide through a respective slot 52a in the left panel 52 or a respective slot (not shown but similar to 52a) in the right panel 53. After the fins 55a slide within the respective slots in the left and right panels 52, 53, the back panel is attached to the frame with fasteners. In other embodiments, the panels maybe connected together and to the frame with other connection structures that are known to those of ordinary skill in the art.

[0028] The plurality of panels 50 additionally include a plurality of apertures 56 that serve as vents, or louvers, to allow air to flow through the enclosed volume of the pressure washer 10 to provide cooling for the enclosed engine 40 and pump 48. Additionally, the rear panel 55 includes an inlet aperture 58 that is formed in-line with the engine intake air filter to provide air flow to the engine 40 for use during the combustion process. Exhaust air exits the engine 40 and the pressure washer 10 through one of the plurality of apertures 56.

[0029] The pressure washer 10 may also include a plurality of operational controls 46 that can be manipulated to change the parameters of the engine 40 during operation to change the rate and pressure of the flow through the output port 42 of the pressure washer 10. For instance, the pressure washer 10 may include a pressure control knob, a kill switch, and a choke control as well as any other controls that can be used to operate pressure washers. Additionally, the section of the pressure washer that includes the operational controls may include any gauges or similar information indicators that are commonly used with pressure washers. As shown in FIG. 2, these operational controls 46 may be extend through the front panel 51 of the pressure washer 10 and above the inlet and outlet ports 42, 44. This ergonomic design allows the operational controls 46 to be positioned close to the top of the unit and in the vicinity of the inlet and outlet ports 42, 44 to allow the unit to be connected and started in the same ergonomic position. In other embodiments, some or all of the operational controls 46 and/or the inlet and outlet ports 42, 44 may be positioned in alternate convenient and efficient locations on the panels 50 that form the exterior surface of the pressure washer 10. For example, the inlet and outlet ports 42, 44 may each be positioned on different panels 50, and the operational controls 46 may be positioned on one of the same panel, or still different panels 50 from which the inlet and outlet ports 42, 44 extend.

[0030] As shown in FIG. 7, a plurality of baffles 22 may be provided and may be connected to the frame 60, the engine or pump 40, 48, or the appropriate panel 50. The baffles 22 direct air that enters the internal volume of the machine within the plurality of panels 50 to flow past the necessary components of the engine 40 or pump 48 to provide for adequate cooling of those components during pressure washer operation. The baffles 22 allow for sufficient air flow past the engine 40 during operation to maintain appropriate cooling of the engine 40 within the enclosed cavity formed by the plurality of panels 50. Additionally, a baffle 22a is provided to ensure that only air from relatively cool air from outside the machine flows through the air filter for use with the combustion process and other baffles 22 are provided to guide the relatively hot exhaust air from the muffler and the crankcase to exit the internal volume of the machine formed by the plurality of panels 50.

[0031] The plurality of panels 50 that substantially surround the engine 40 and the pump 48 substantially prevents the user from contacting the engine 40 and the

pump 48 during and after extended operation, which reduces if not eliminates any potential for burn injuries. Additionally, the plurality of panels 50 that are attached to the frame 60 provide an aesthetic appearance and pleasing design of the unit.

[0032] As shown in FIG. 7, the top panel 54 may be formed with a plurality of receptacles 59a, 59b to accept and retain some of the plurality of external tools for use with the pressure washer 10. For example, the top panel 54 includes a receptacle 59a that accepts and retains a spray gun 92 and a lance 94 for use with the pressure washer. Additionally, the top panel 54 may include a plurality of apertures 59b for accepting the male end 96a of a nozzle 96 for use with the pressure washer 10. In other embodiments, the receptacles 59a, 59b can be included on other portions of the external surface of the pressure washer, and additional/alternate receptacles can be provided to retain other external components, such as hoses 98 etc. Commonly assigned application U.S.S.N. 11/367,117, filed on March 3, 2006 fully describes the use and operation of the receptacles and apertures 59a, 59b as well as the design of the panels 50 and their connection to the frame 60. This application is fully incorporated herein by reference.

[0033] As mentioned above, the structures discussed above can also be successfully implemented with a generator, an air compressor, or with a plurality of other portable machines including a fuel powered engine. Specifically, in an alternate embodiment where the machine is a generator, the output shaft of the engine 40 is operatively connected with a generator, wherein rotor (not shown) of the generator rotates with the output shaft and includes a plurality of magnets. As understood by those of ordinary skill in the art, the stator (not shown) of the generator is fixed to the frame and surrounds the rotor and includes a plurality of coils of wire. When the rotor is rotated by the engine, a current is generated in the stator windings due to the oscillating magnetic field felt by the stator windings. Accordingly, a current is produced in the stator windings that are connected to a plug or similar electrical connector (not shown) located on the exterior of the housing 20. The operational controls 46 may be adjusted to adjust engine operation to adjust the frequency of the current generated by the generator, which is proportional to the speed of the motor output shaft. The voltage is set by the manufacturer and is proportional to the magnetic field on the rotor.

[0034] In other embodiments, the machine can be formed as an air compressor. The components of the air compressor are generally the same as those discussed above with respect to the pressure washer, except the pump 48 is designed to increase air pressure. The air compressor includes inlet and outlet ports 42, 44 and corresponding pipes 42a, 44a, an engine 40 that drives the compressor pump 48 and operational controls 46 to manipulate the operation of the engine to adjust the output pressure of the unit.

[0035] The foregoing disclosure is the best mode devised by the inventors for practicing this invention. It is apparent, however, that apparatus incorporating modifications and variations will be obvious to one skilled in the art. Inasmuch as the foregoing disclosure is intended to enable one skilled in the pertinent art to practice the instant invention, it should not be construed to be limited thereby but should be construed to include aforementioned obvious variations and be limited only by the spirit and scope of the following claims.

[0036] It is therefore intended that the foregoing detailed description be regarded as illustrative rather than limiting, and that it be understood that it is the following claims, including all equivalents, that are intended to define the spirit and scope of this invention.

Claims

1. A pressure washer comprising:

(a) a fuel powered engine including an output shaft that rotates with engine operation and extending substantially downward from the engine;
(b) a working member rotatably coupled to the output shaft and located substantially below the engine;
(c) a frame rigidly supporting the engine and the working member;
(d) a plurality of panels mounted to the frame to substantially enclose the engine and the working member;
(e) a plurality of apertures formed in the plurality of panels suitable for air flow through the apertures and past the engine and the working member;
(f) operational controls positioned on the plurality of panels for controlling the operation of the fuel powered machine; and
(g) an outlet connector provided through one of the plurality of panels.

2. The pressure washer of claim 1 wherein the operational controls and the outlet connector are provided on a front panel of the plurality of panels.

3. The pressure washer of claim 1 or 2 wherein the working member is a positive displacement pump.

4. The pressure washer of claim 1, 2 or 3 further comprising an inlet connector located on the same one of the plurality of panels as the outlet connector and in the vicinity of the outlet connector.

5. The pressure washer of claim 4 wherein the inlet and outlet connectors are positioned on a front panel of the plurality of panels.

6. The pressure washer of claim 5 wherein the operational controls are positioned on the front panel and the inlet and outlet connectors are located below the operational controls on the front panel.

7. The pressure washer of any preceding claim further comprising a plurality of baffles connected with one of the engine or the frame for directing air flow through the substantially enclosed engine.

8. The pressure washer of any preceding claim further comprising a base plate connected to the frame and rigidly supporting both the fuel powered engine and the working member on opposite sides of the base plate.

9. The pressure washer of claim 1 wherein the operational controls are positioned on one of the plurality of panels.

10. A pressure washer comprising:

(a) an engine with an output shaft extending substantially vertically below the engine;
(b) a pump operationally connected to the output shaft;
(c) a frame supporting both the engine and the pump;
(d) a plurality of panels mounted to the frame to substantially enclose the engine and the pump;
(e) a plurality of apertures formed in the plurality of panels suitable for air to flow through the apertures for engine and pump cooling and for use with the combustion cycle of the engine;
(f) an output connector provided on one of the plurality of panels; and
(g) an inlet connector provided on one of the plurality of panels.

11. The pressure washer of claim 10 further comprising operational controls positioned on one of the plurality of panels for controlling the operation of the fuel powered machine.

12. The pressure washer of claim 11 wherein the inlet connector, the output connector, and the operational controls are each positioned on a front panel of the plurality of panels.

13. The pressure washer of claim 12 wherein the inlet connector and the output connector are each positioned below the operational controls and substantially in-line with the pump.

14. The pressure washer of any one of claims 10 to 13 wherein the plurality of panels substantially enclose the front side, the back side, the right side, the left side, and the top of the engine and the pump.

15. The pressure washer of any one of claims 10 to 13 wherein the plurality of panels do not contact the engine or the pump.

16. The pressure washer of claim 15 wherein the plurality of panels further comprise left and right panels that are mounted to the frame.

17. The pressure washer of claim 16 wherein the left and right panels each include a slot extending from a rear edge of each of the left and right panels, and the plurality of panels further comprises a rear panel with fins that extend from a left side and a right side of the rear panel, wherein the fins are slidably mounted within the slots on each of the left and right panels to connect the rear panel to the left and right panels.

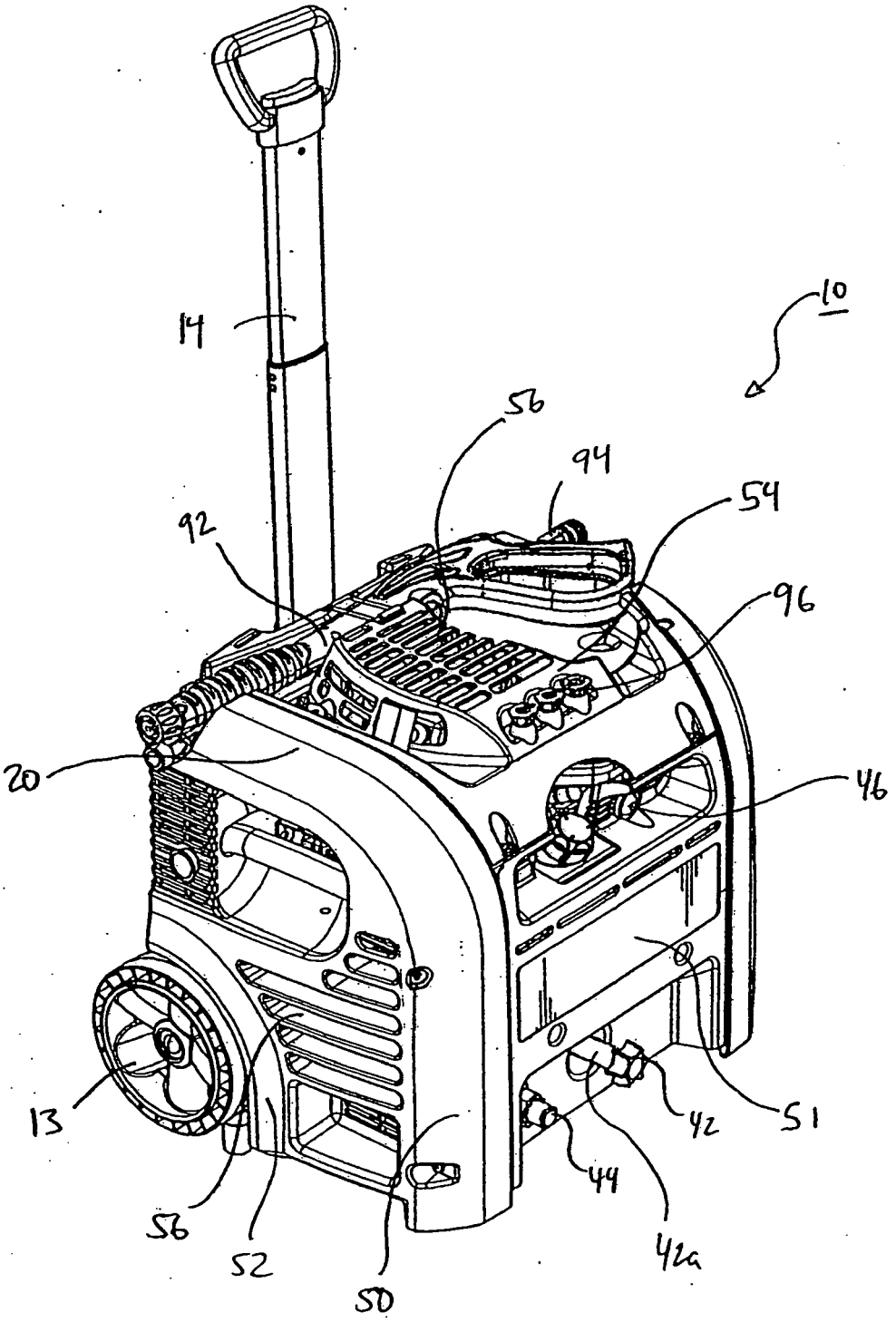


FIG. 1

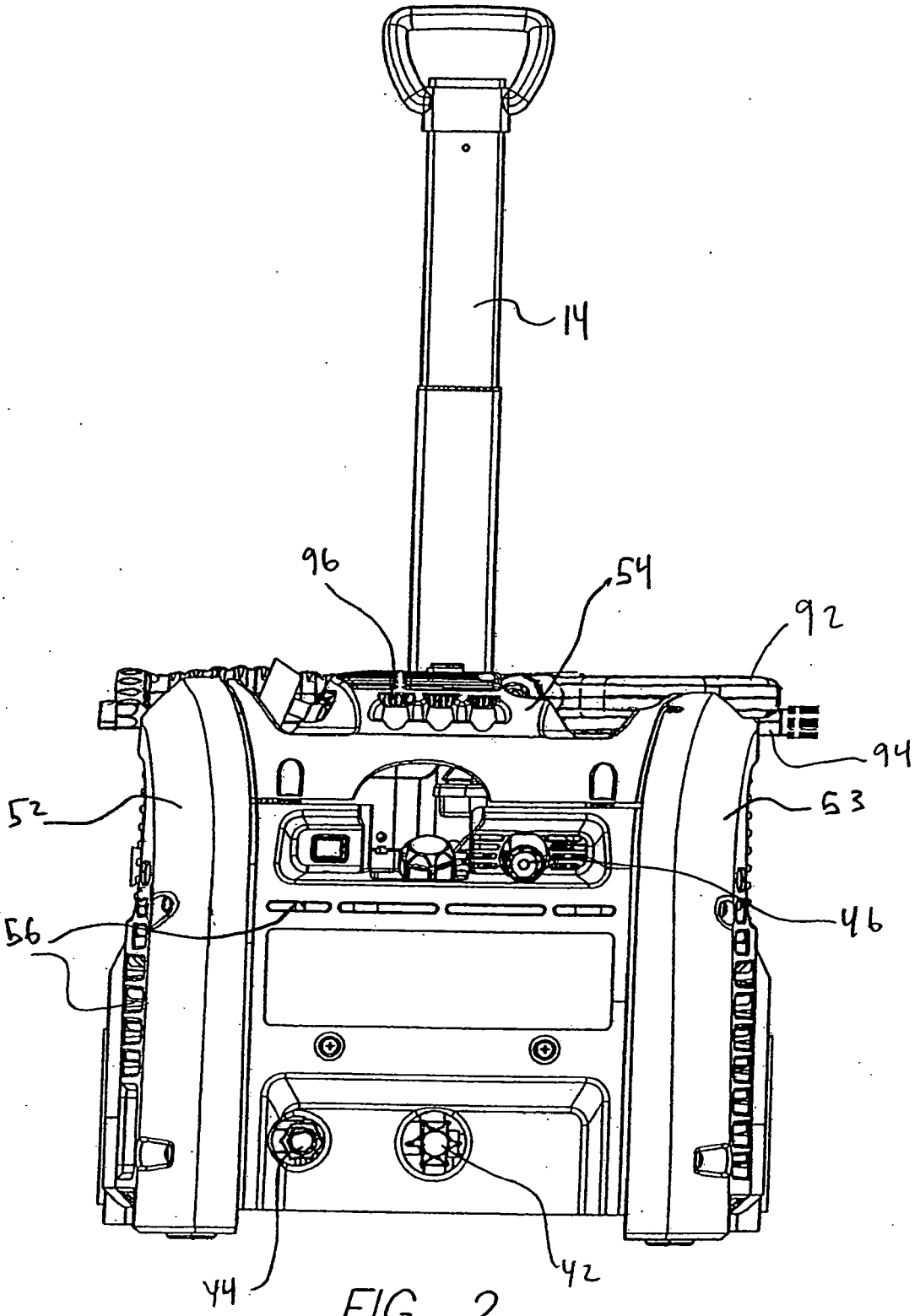


FIG. 2

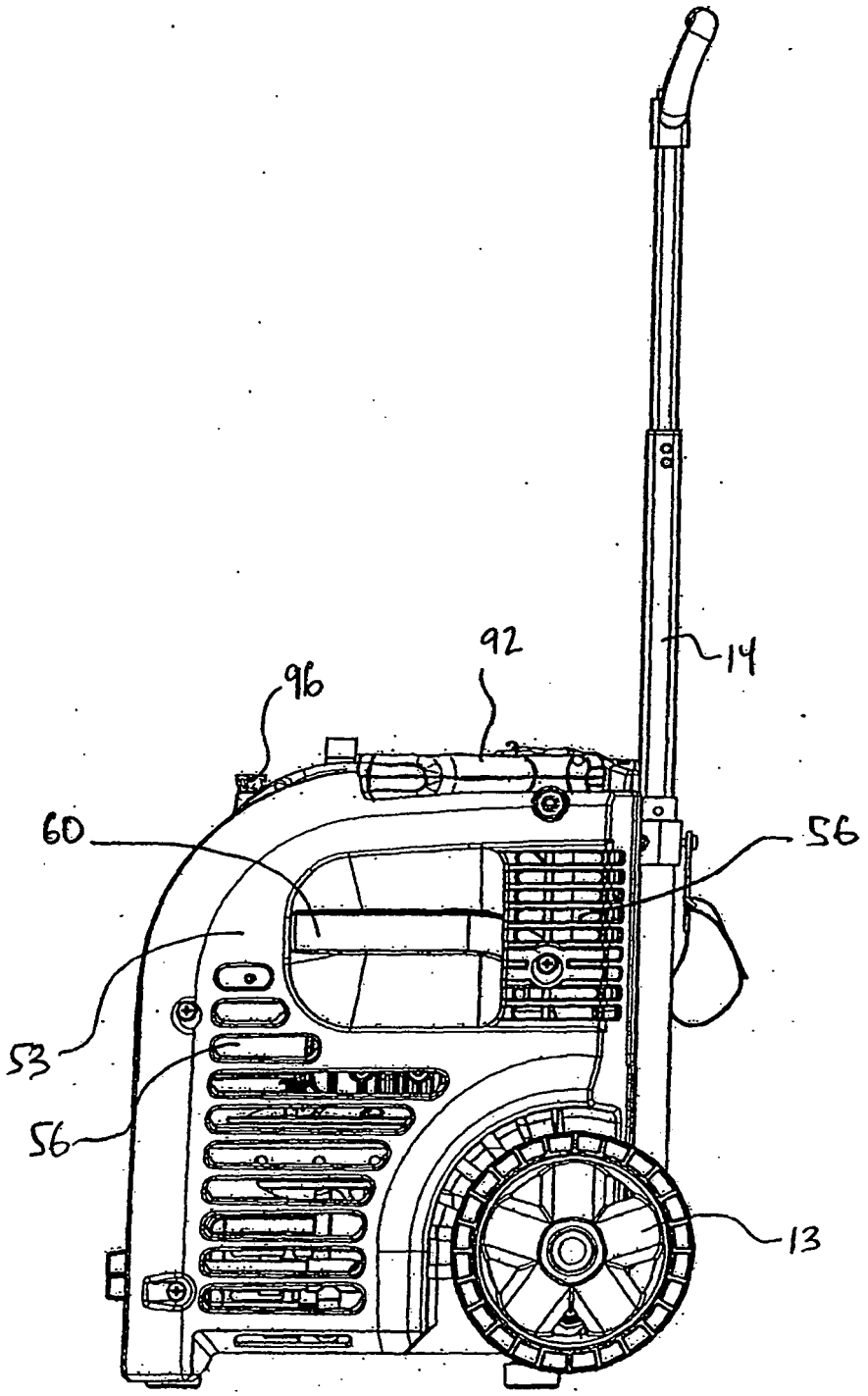


FIG. 3

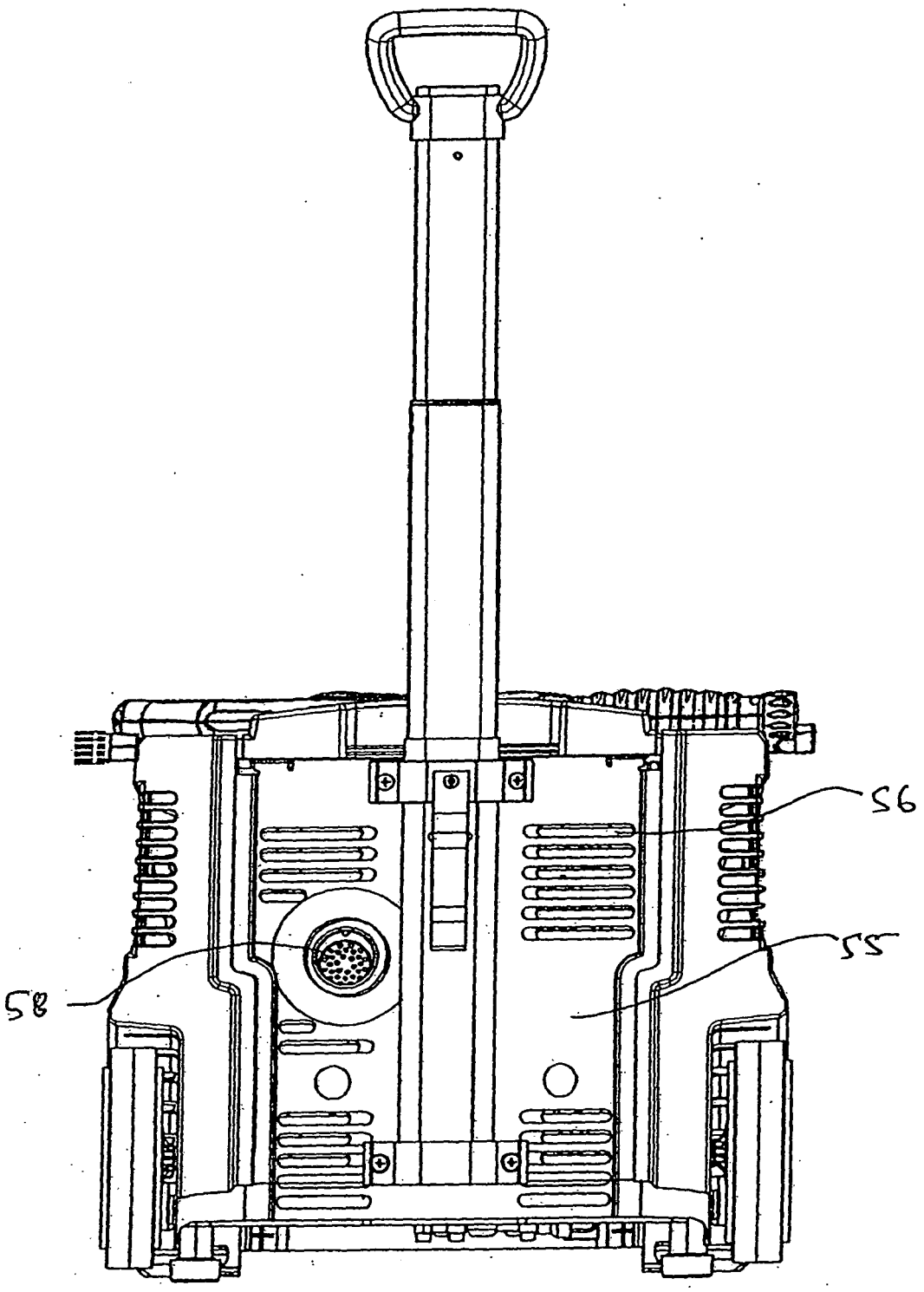


FIG. 4

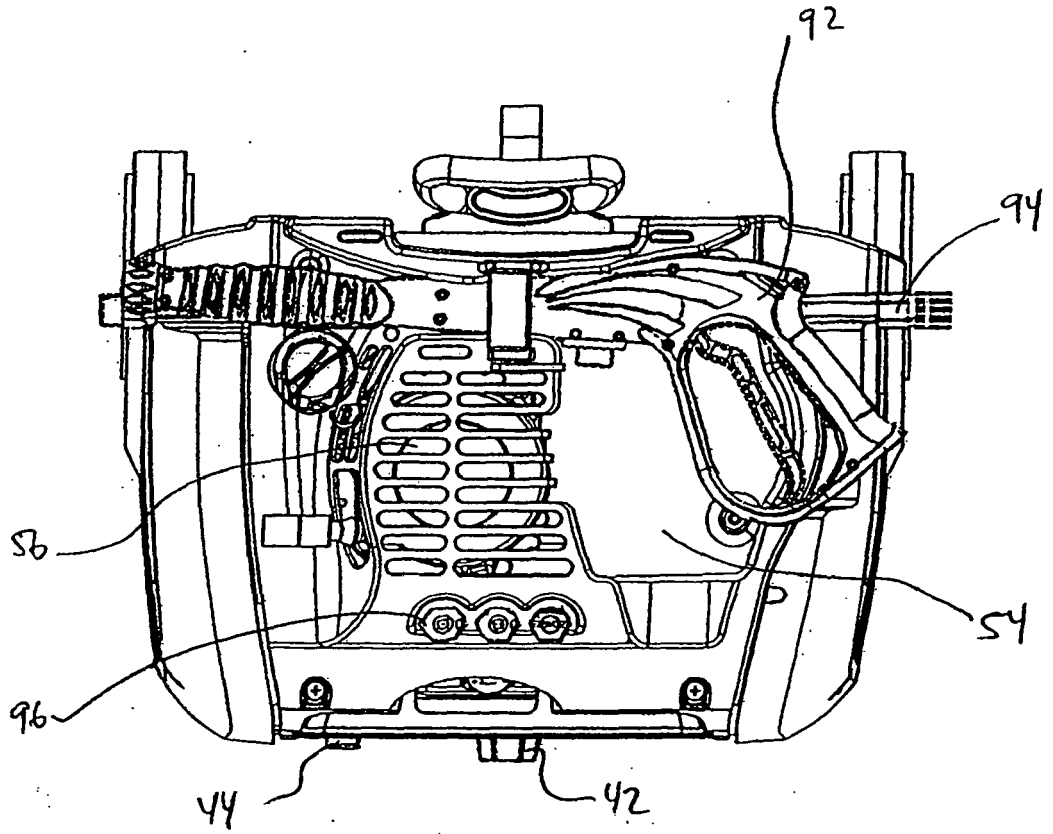


FIG. 5

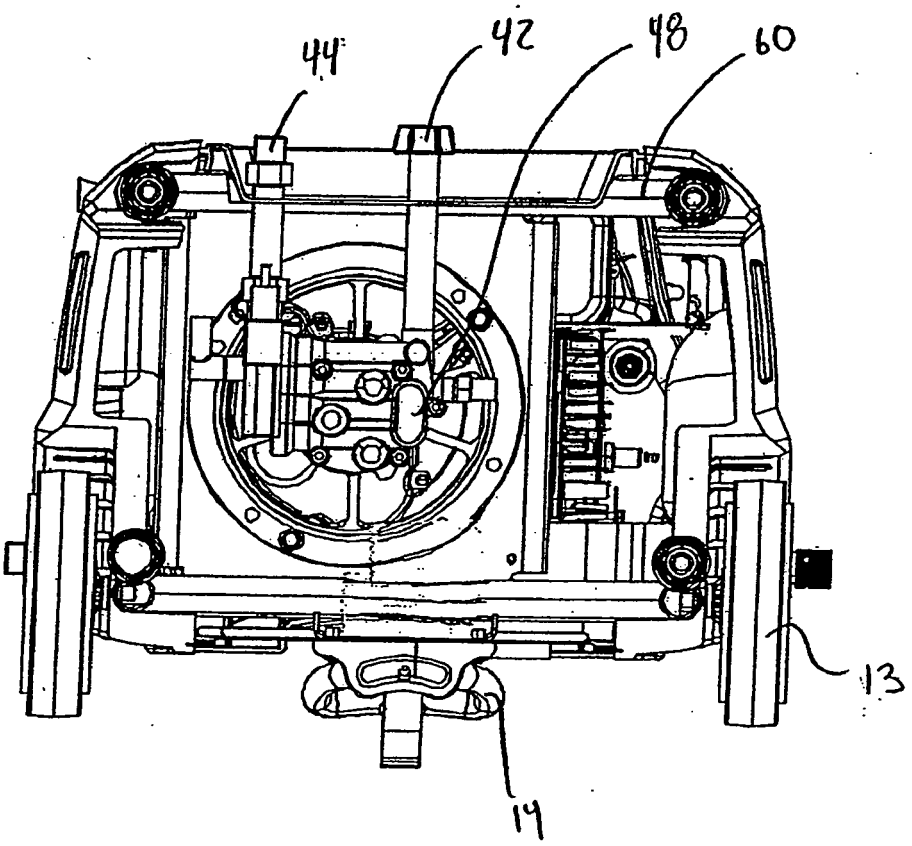


FIG. 6

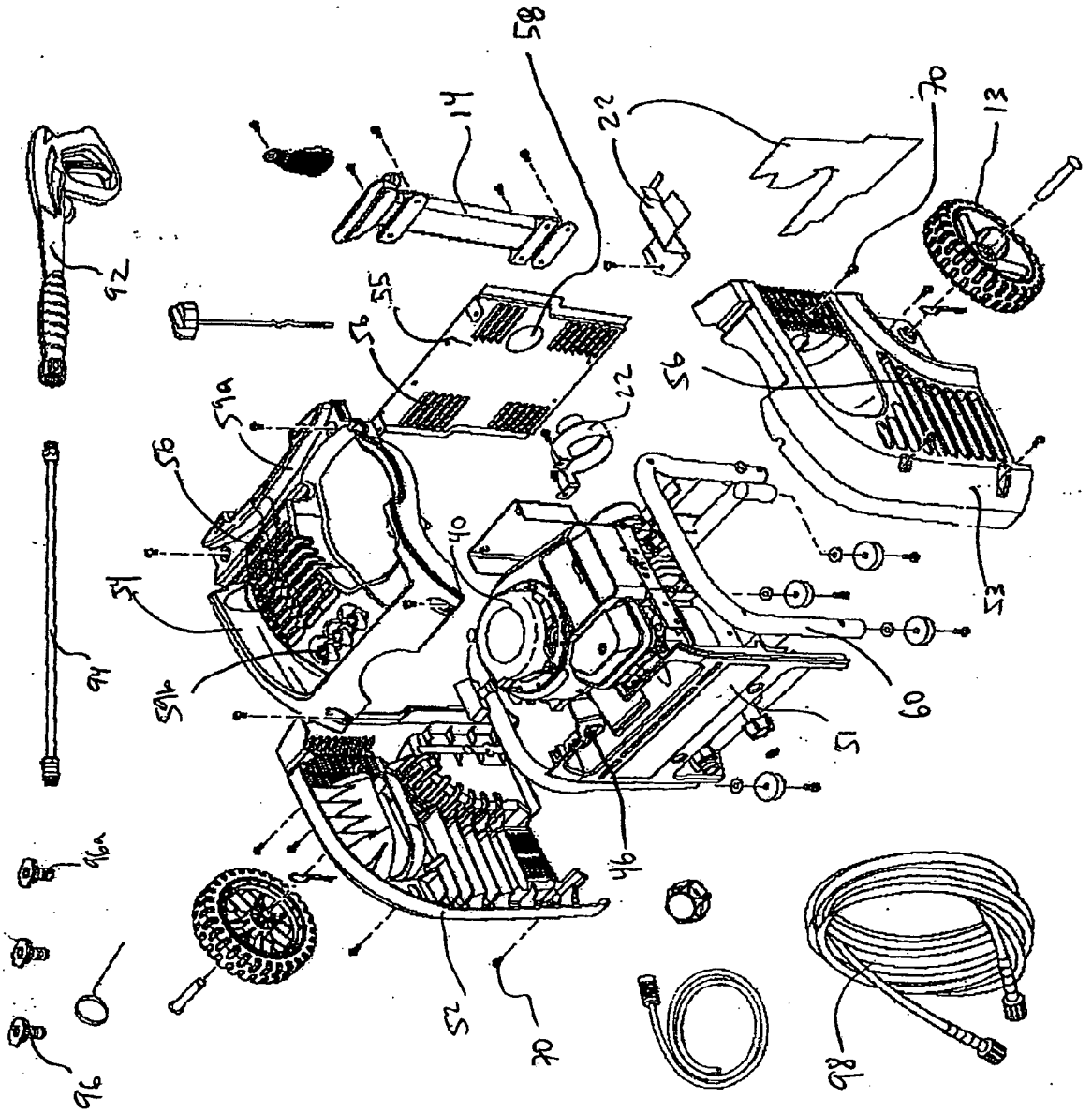


FIG. 7

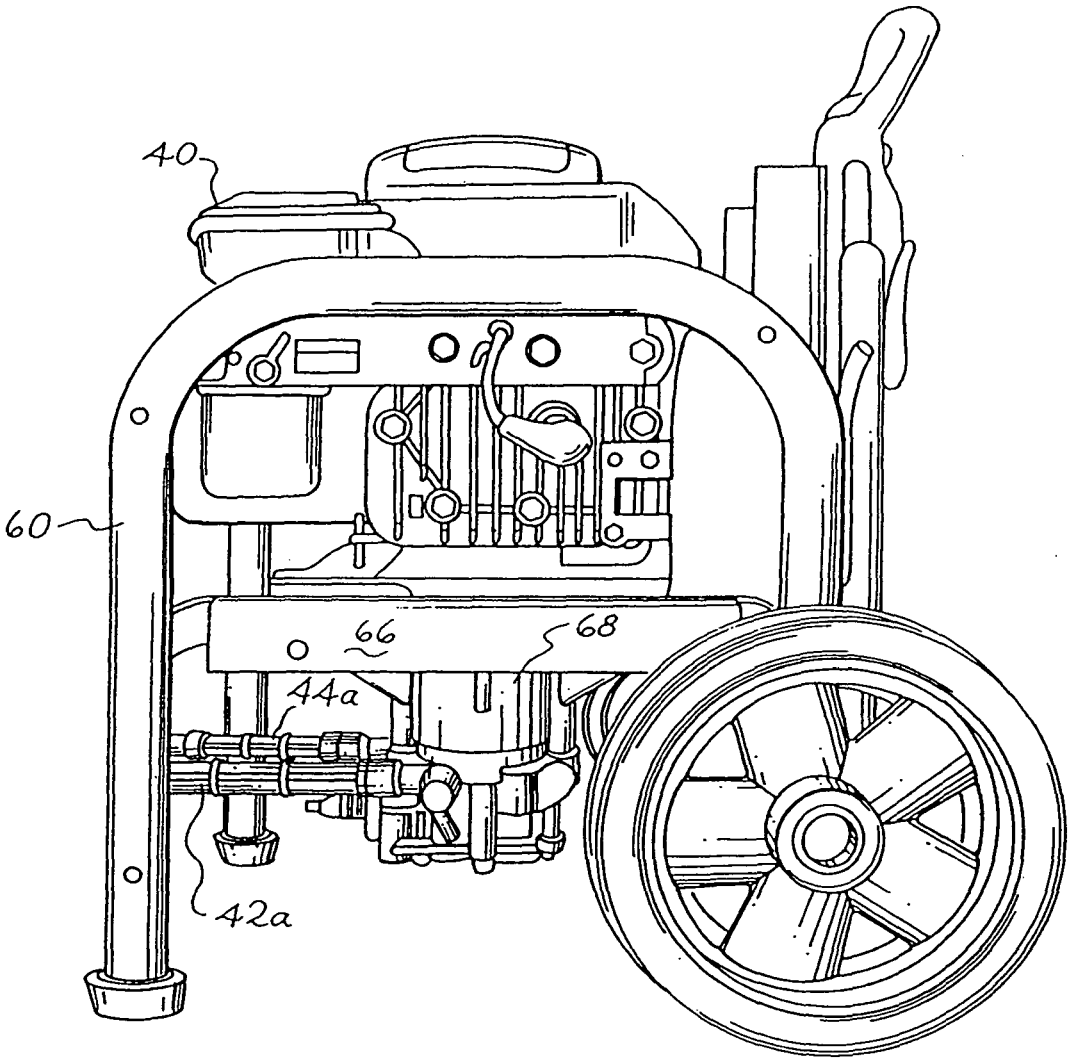


FIG. 8

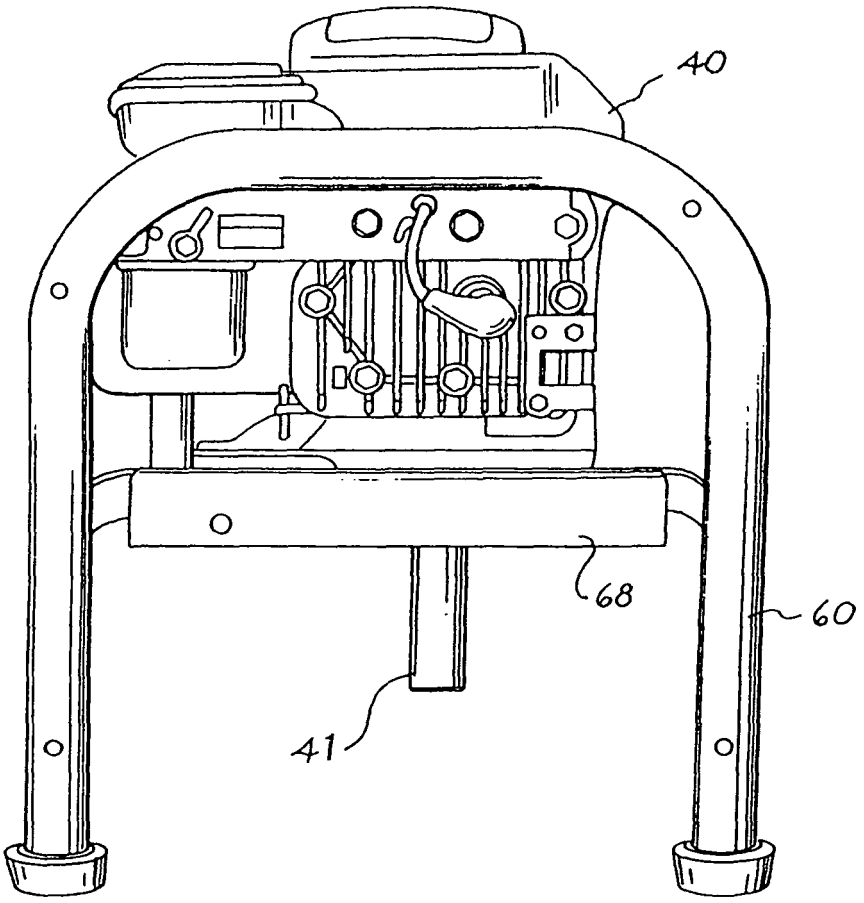


FIG. 9

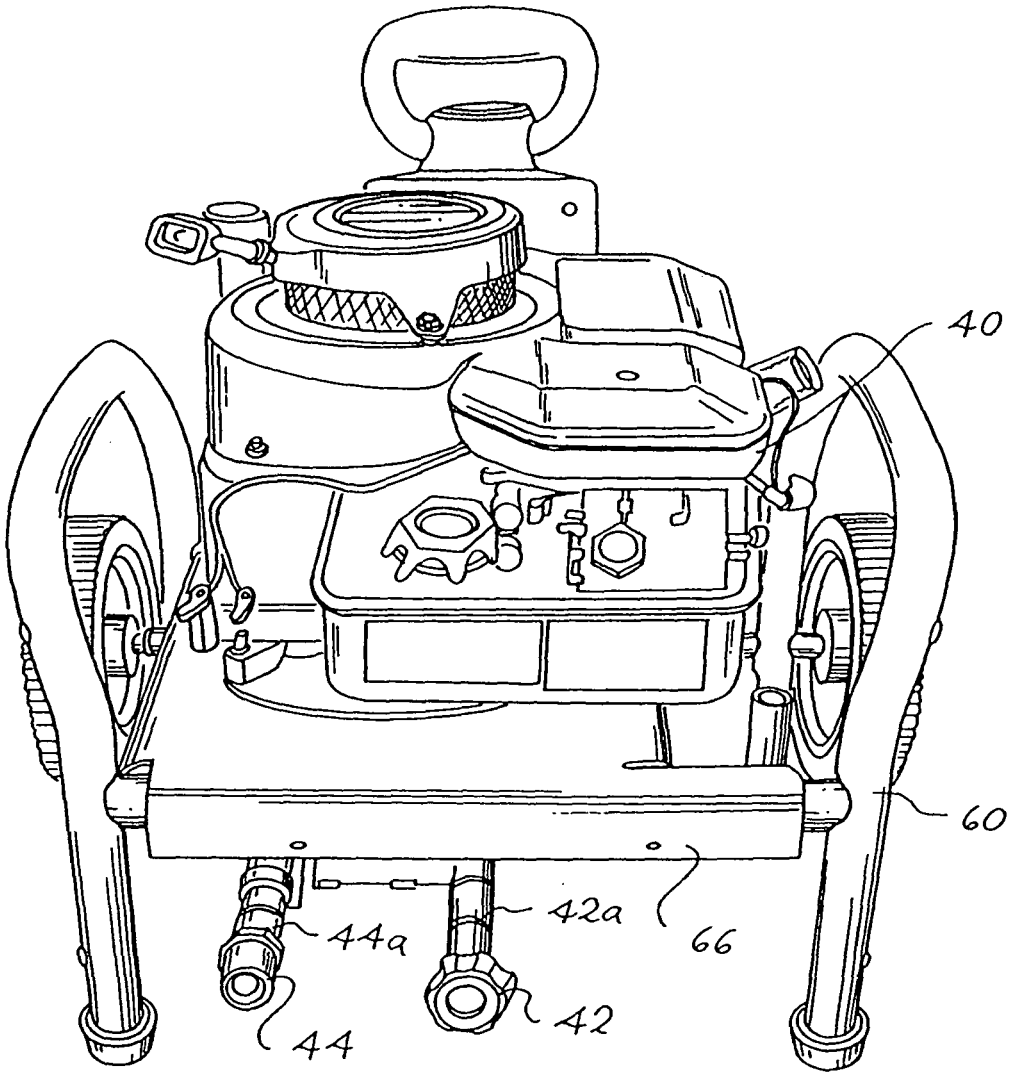
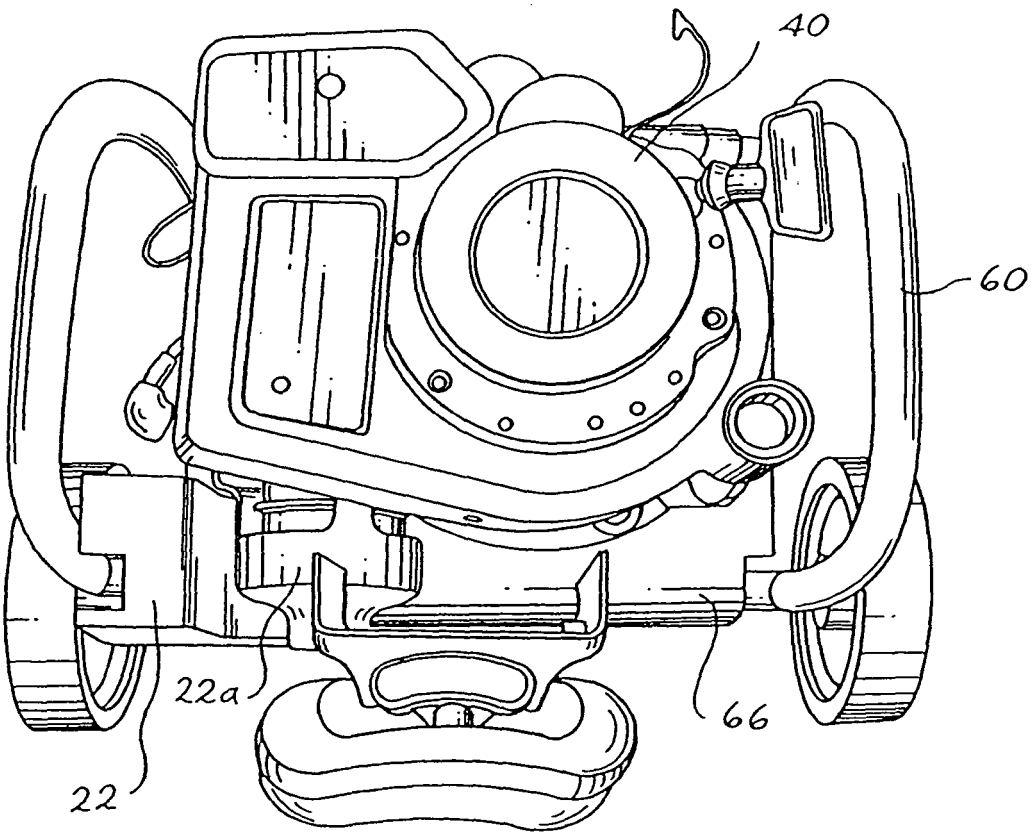


FIG. 10

FIG. 11



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 25 4111

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 103 30 917 B3 (KAERCHER GMBH & CO KG ALFRED [DE]) 4 November 2004 (2004-11-04) * paragraph [0036]; figure 4 *	10-15	INV. B05B9/04 F04B35/00 F04B39/12 F04B35/06 B08B3/02 F04B17/05 F04B17/06 B25F5/02
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The present search report has been drawn up for all claims

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