

[54]	WASTE DISPOSAL SYSTEM AND METHOD	3,504,797	4/1970	Reid.....	123/1
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[73]	Assignee: The Standard Products Company, Cleveland, Ohio	3,342,337	6/1967	Reid.....	123/1
		2,677,234	5/1954	Secord.....	123/1
		3,633,746	1/1972	Dieterich	123/1
[22]	Filed: Jan. 31, 1972	3,586,170	6/1971	Reid.....	123/1
		3,612,278	10/1971	Dietrich	123/1
[21]	Appl. No.: 222,129	3,616,913	11/1971	Reid.....	123/1

Related U.S. Application Data

[63]	Continuation of Ser. No. 843,585, July 22, 1969, abandoned.
[52]	U.S. Cl..... 60/317, 123/1 A, 210/149, 210/152, 4/131
[51]	Int. Cl..... F01n 3/02, B01d 3/00
[58]	Field of Search..... 123/1; 60/317; 210/149, 152; 4/131

References Cited

UNITED STATES PATENTS

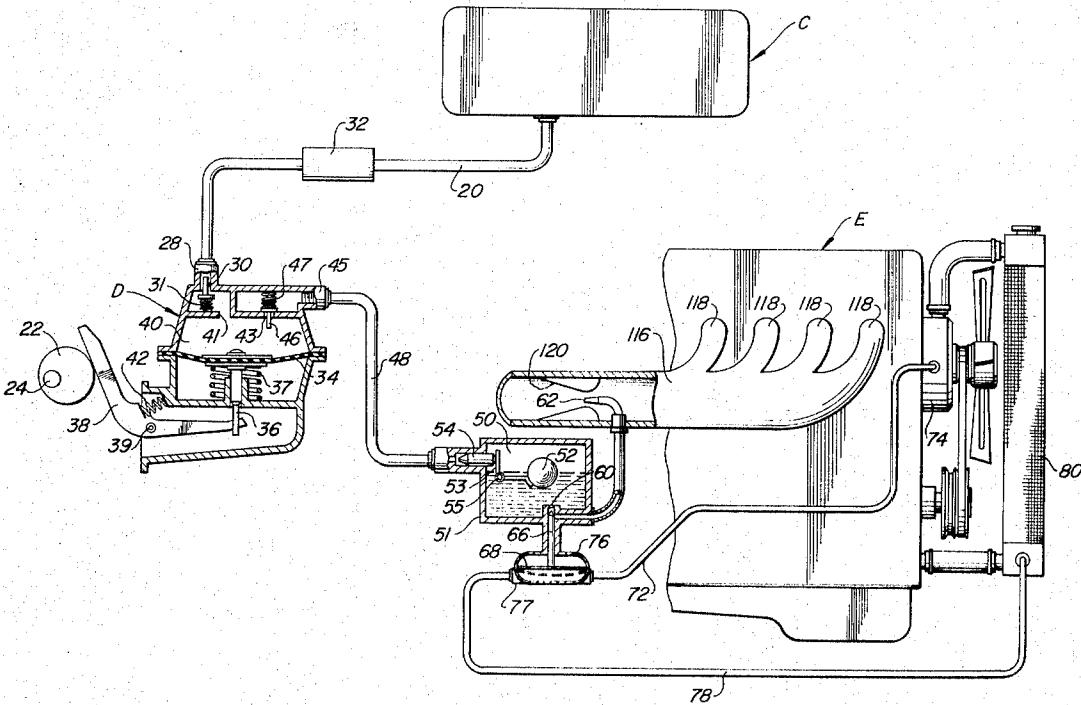
2,565,720	8/1951	Collison	4/131
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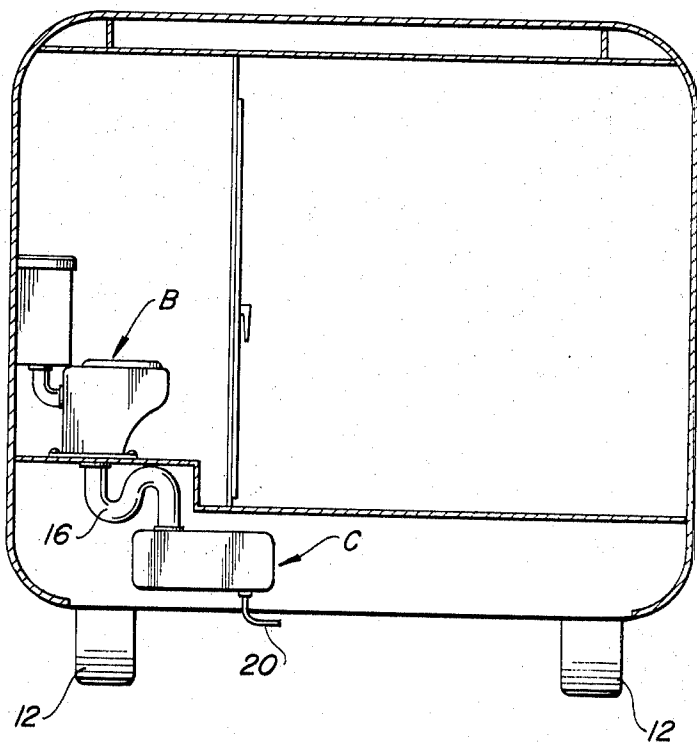
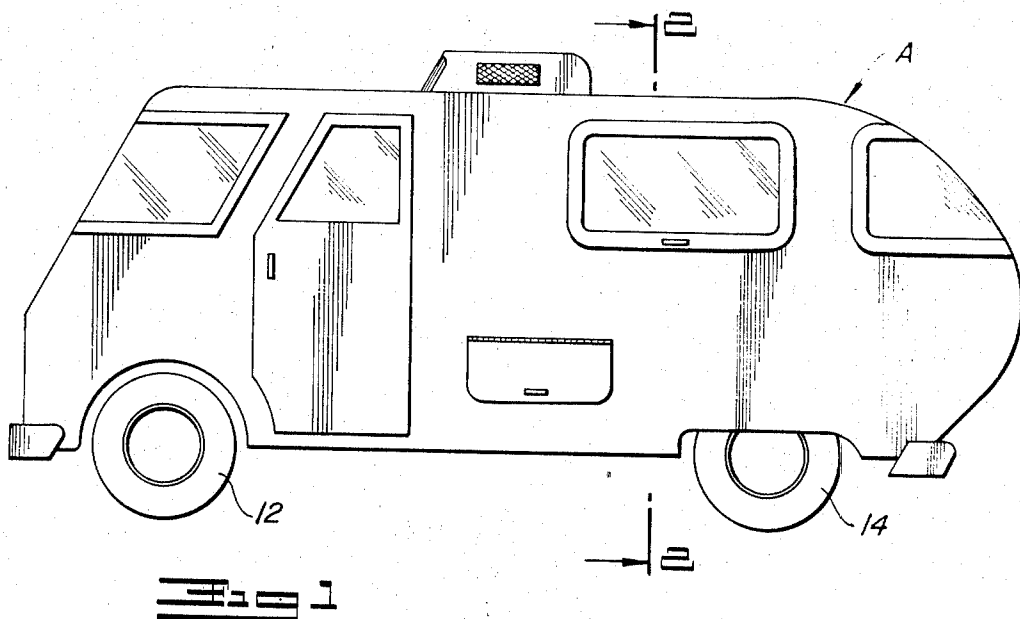
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[57] ABSTRACT

A human conveyance having a toilet and a fuel burning engine is provided with an arrangement for feeding waste from the toilet to the fuel burning engine where the waste is burned and vaporized.

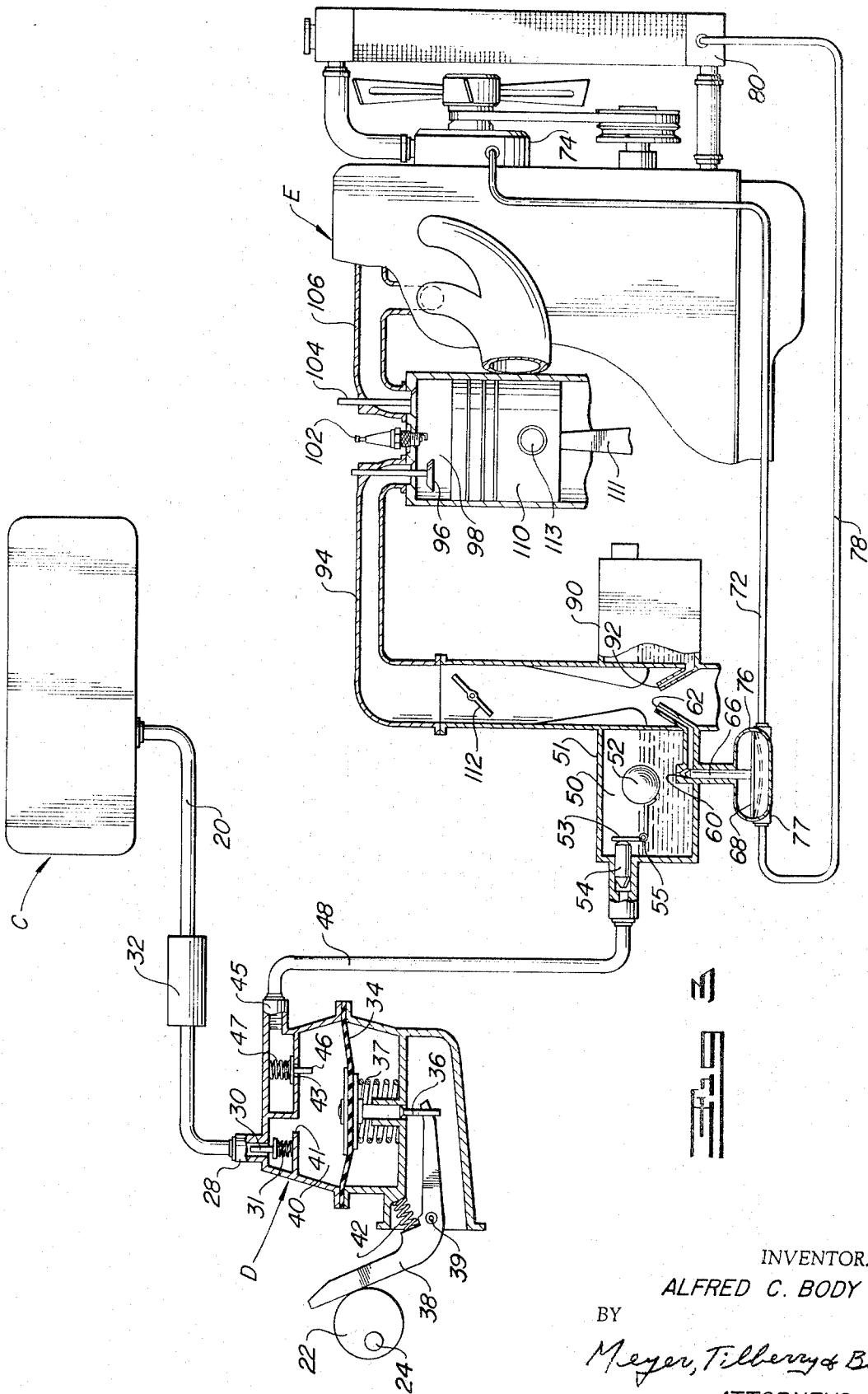
8 Claims, 6 Drawing Figures





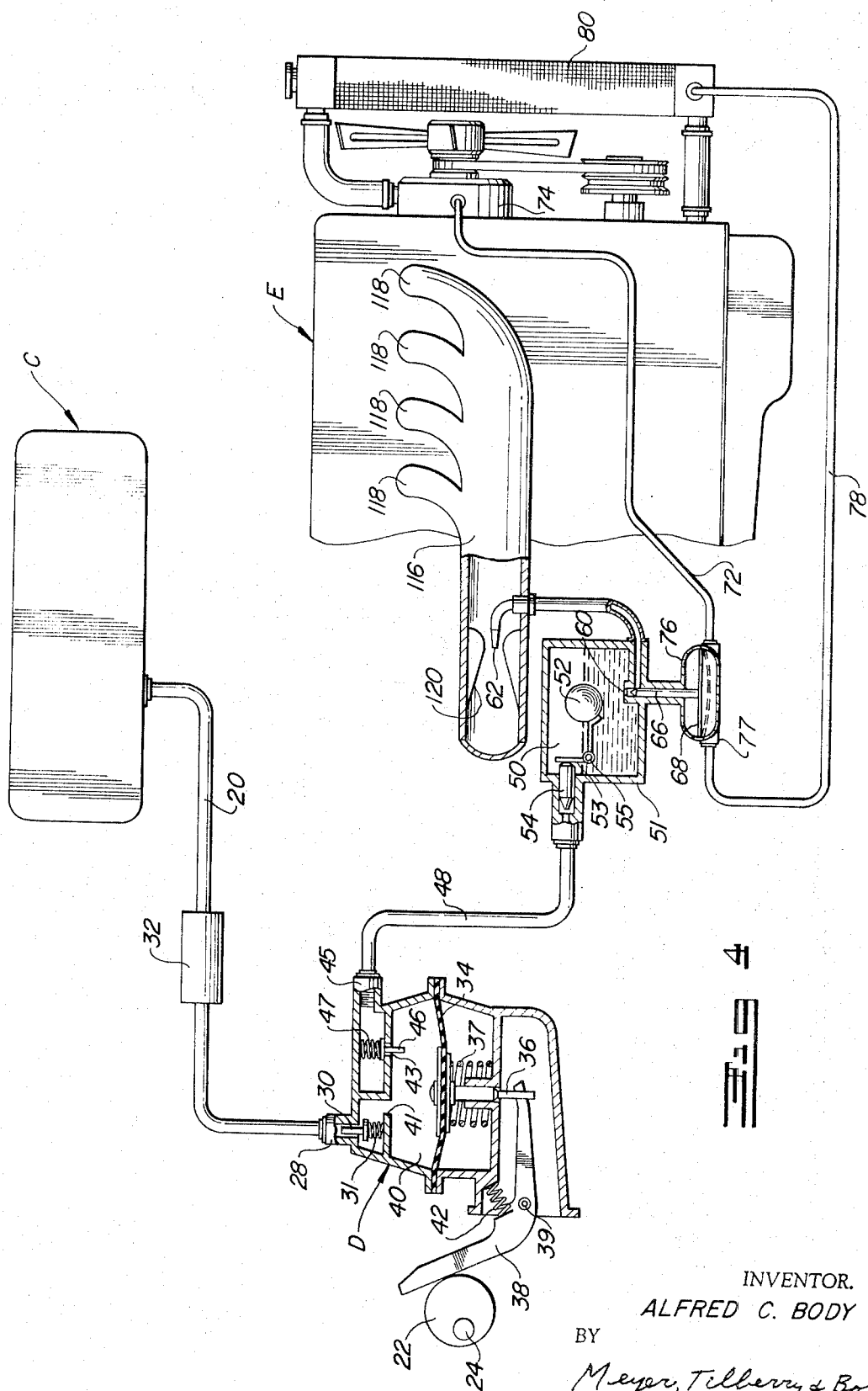
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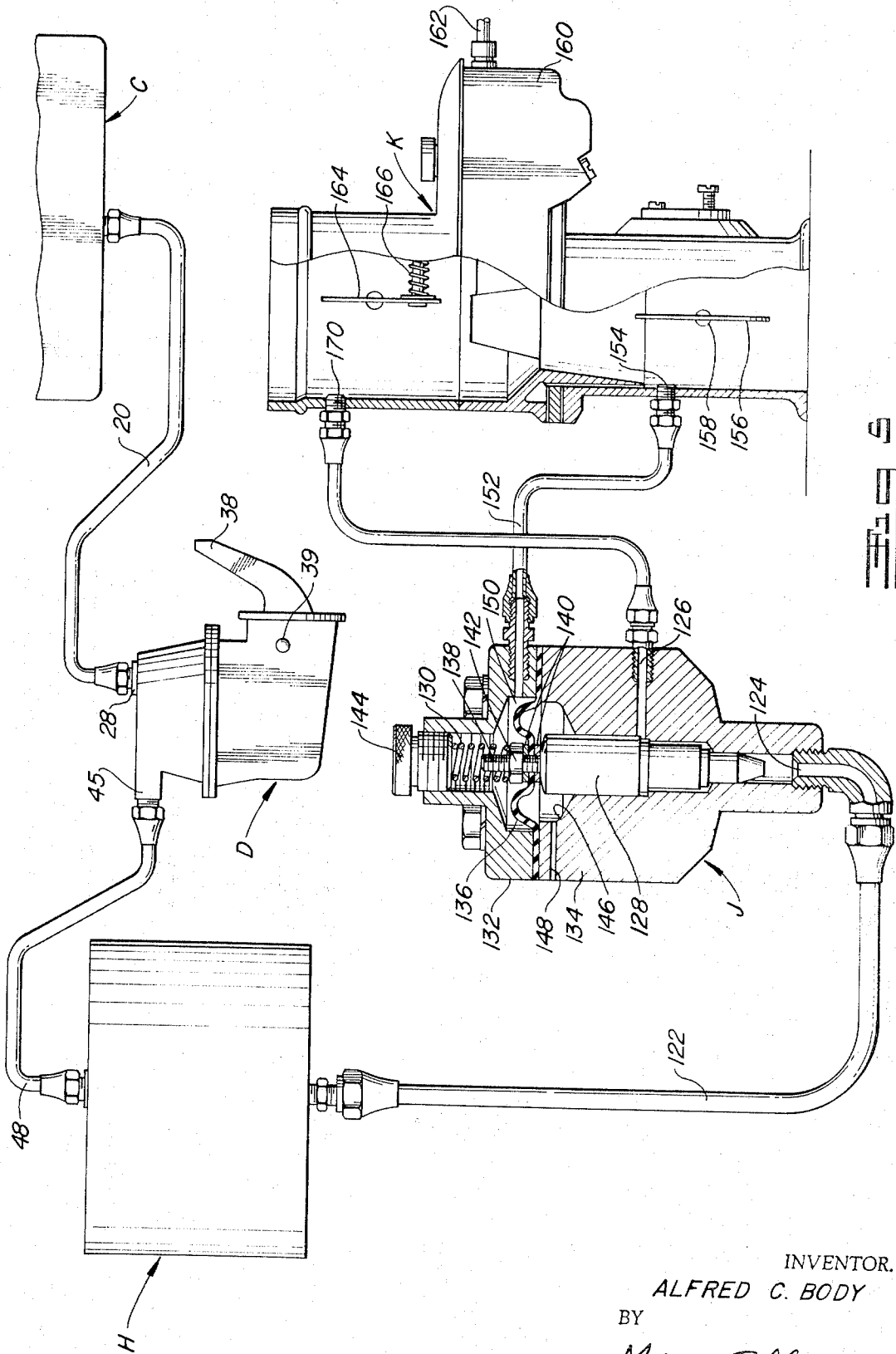


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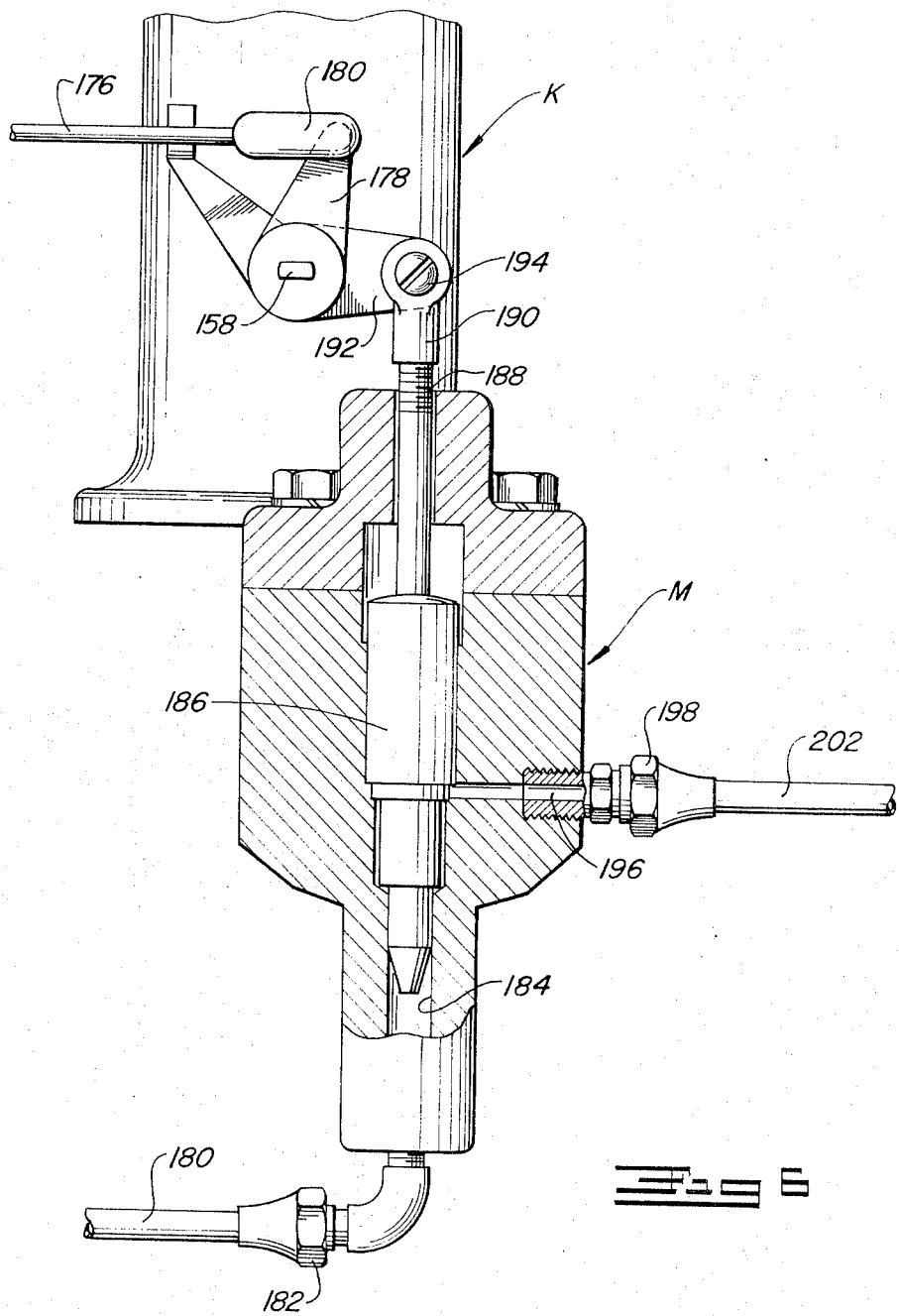
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WASTE DISPOSAL SYSTEM AND METHOD

This is a continuation of application Ser. No. 843,585 filed July 22, 1969.

BACKGROUND OF THE INVENTION

This application pertains to the art of waste disposal and more particularly to disposal of human waste from a toilet on a human conveyance which is propelled by a fuel burning engine. The invention is particularly applicable to human conveyances such as camping vehicles having internal combustion engines and will be described with particular reference thereto, although it will be appreciated that the invention has broader applications and may be used in other human conveyances such as buses, boats or airplanes. It will also be appreciated that the invention is useful with human conveyances having fuel burning engines of the type known as spark ignition, compression ignition, or turbine.

Modern human conveyances, such as camping vehicles or trailers, buses, boats and airplanes, are commonly provided with toilets for use by human occupants of the conveyance. Such toilets commonly have an outlet leading to a storage tank for waste. The waste storage tank also commonly receives waste from a lavatory or the like within the conveyance.

In boats, it has been common practice to discharge raw waste from the storage tank directly into a body of water. This discharge of raw waste into a body of water consumes a large amount of oxygen from the water and creates pollution. When such waste is frequently discharged into a body of water at a short distance from the shoreline, recreation areas along the shoreline are commonly destroyed by the resulting pollution. On other human conveyances, such as buses, camping vehicles or airplanes, the necessity of conserving as much space as possible in making the conveyance compact severely limits the volumetric capacity of the waste storage tank. Therefore, such waste storage tanks on such conveyances commonly have a capacity to hold only as much waste as is normally discharged from the toilet and lavatory in one or two days. Emptying the waste storage tank at such frequent intervals is an extremely onerous task. Discharge facilities for such wastes are not readily available at convenient locations and even when they are, it is necessary to connect a hose or carry the waste in buckets from the storage tank to a discharge opening of a sewer leading to a sewage treatment plant.

In some prior art arrangements, it has been suggested that liquid effluent from the waste storage tank be directed to a boiler where the liquid is evaporated and discharged to atmosphere. One prior arrangement of this type is disclosed in U.S. Pat. No. 3,342,337 to Reid. In such an arrangement, the liquid effluent reaches a temperature of only around 212°F. while being evaporated and discharged to atmosphere. At such a temperature, many bacteria and odor producing compounds in the evaporated effluent may not be destroyed.

It would be desirable to burn and vaporize effluent from the waste storage tank at an extremely high temperature which would destroy bacteria in the effluent and break down many of the odor producing compounds. It would also be desirable to eliminate the requirement of a boiler for first evaporating the effluent and to burn and vaporize the effluent by subjecting it

to an extremely high temperature. It would also be desirable to perform such an operation within the conveyance itself by utilizing existing heat sources so that it would not be necessary to empty the waste storage tank and the only operation required would be that of cleaning the waste storage tank at periodic intervals such as one or two times a year.

SUMMARY OF THE INVENTION

In accordance with the present invention, a human conveyance having a toilet and a fuel burning engine is provided with an arrangement for directly consuming waste from the toilet by feeding the waste directly to the hottest part of the engine. Namely, to the combustion chamber itself or immediately adjacent the exhaust. More specifically, the conveyance is provided with a small storage tank for receiving waste from a toilet or lavatory and a conduit extends from the storage tank to the engine for feeding waste from the storage tank to the high temperature areas of the engine. In accordance with one arrangement, the conduit extends from the storage tank to the air intake of the engine. In another aspect the waste is injected directly into the combustion chamber in a manner similar to that of the diesel engine. In another arrangement, a control device is provided for feeding waste from the storage tank to the engine at a rate which is proportional to the operating speed of the engine. In accordance with another aspect of the invention, a temperature responsive control device is provided to allow feeding of waste from the storage tank to the engine only when the engine has been warmed to its normal operating temperature. With these arrangements, waste from the storage tank is fed directly to the combustion chamber of the engine where temperatures may be as high as 5,000-6,000°F. Waste thus fed into the combustion area is completely burned and vaporized at this extremely high temperature so that bacteria and odor producing compounds in the waste are substantially destroyed.

In accordance with the present invention, it is possible to discharge tiny broken down particles directly into the combustion area of the engine along with liquid effluent as such tiny particles are completely consumed at the high temperature existing within the combustion chamber.

In accordance with another aspect of the invention, effluent from the storage tank is fed directly to the exhaust port of the engine in an area directly adjacent the exhaust port from the combustion chamber. Exhaust gases from the combustion chamber of the fuel burning engine may be around 1,200-2,000°F. Such gases normally lose a substantial portion of their heat by radiation and conduction into the exhaust piping leading from the engine to atmosphere. In accordance with the present invention, the effluent from the storage tank is directed into the exhaust gases when they are at their highest temperature and before they have lost any heat by traveling through the exhaust system. This insures substantially complete vaporization and burning of effluent and tiny particles of waste from the storage tank. In addition, discharging the effluent from the storage tank into the exhaust gases directly at their point of exit from the combustion chamber, subjects the vaporized material to a high temperature for a considerable period of time during travel through the exhaust system. For example, discharging such effluent into an exhaust system closely adjacent to the point of discharge of the

exhaust to atmosphere, subjects the effluent to a higher temperature for a very brief period of time. In accordance with the present invention, the vaporized material must travel with the exhaust gases through the entire exhaust system prior to being discharged to atmosphere.

It will be recognized that the present invention is usable with human conveyances having a self-contained engine for providing motive power to the conveyance. However, it will be recognized that such devices as camping trailers may have conduit means leading from a waste storage tank in the trailer to an engine in a separate vehicle which is used to tow the trailer.

It is a principle object of the present invention to provide a human conveyance with an arrangement for disposing of waste from a toilet or the like by consuming such waste with heat from an engine which provides motive power to the conveyance.

It is another object of the present invention to provide such a waste disposal system in which the flow of waste material from a storage tank to an engine is controlled at a rate proportional to engine operating speed.

It is also an object of the present invention to provide such a waste disposal system in which waste material is fed to the engine only after the engine has reached its normal operating temperature.

It is a further object of the present invention to provide such a waste disposal system in which waste from a storage tank is directly consumed and vaporized by heat from an engine without requiring any preliminary treatment of the waste.

It is an additional object of the present invention to provide an improved method for disposing of waste on a human conveyance having a toilet and a fuel burning engine.

It is a further object of the present invention to direct waste material to the hottest part of a fuel burning engine so that bacteria, solid particles, odor producing compounds and liquid in the waste will be substantially consumed by burning and vaporization.

BRIEF DESCRIPTION OF THE DRAWING

The invention may take physical form in certain parts and arrangements of parts, preferred embodiments of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof.

FIG. 1 is a side elevational view of a human conveyance having the present invention incorporated therein;

FIG. 2 is a cross-sectional view looking in the direction of arrows 2—2 of FIG. 1;

FIG. 3 is a fragmentary side elevational view of the driving engine for the conveyance of FIGS. 1 and 2 having the present invention incorporated therein;

FIG. 4 is a fragmentary side elevational view of the driving engine for the conveyance of FIGS. 1 and 2 incorporated therein;

FIG. 5 is a side elevational view of a control arrangement for use with the present invention and with portions in section for clarity of illustration; and

FIG. 6 is a side elevational view of a modified control arrangement for use with the present invention and with portions in section for clarity of illustration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, wherein the showings are for purposes of illustrating preferred embodiments of the invention only and not for purposes of limiting same, FIG. 1 shows a human conveyance A including wheels 12 and 14, either of which are suitably driven by an internal combustion engine contained in conveyance A. The engine for supplying driving power to the wheels of conveyance A may be a spark ignition engine, a compression ignition engine or a turbine. While conveyance A is shown and described with reference to a camping vehicle or the like it will be recognized that the human conveyance could also be a trailer, boat, bus or aircraft. Conveyance A includes toilet means B having a discharge outlet 16 leading to a waste holding tank C. Solid particles of waste in tank C are subjected to anaerobic bacterial action and the solid particles are broken down. An outlet conduit 20 leads from waste tank C to a pump D. Pump D may be similar to a fuel pump which is operated by an eccentric 22 on cam shaft 24 of engine E which provides motive power to conveyance A. Conduit 20 leads to inlet 28 of pump D which contains a valve 30 biased to a closed position by spring 31. If desired, a filter 32 may be provided in conduit 20 for trapping large solid particles. Pump D includes a diaphragm 34 having a rod 36 connected thereto and rod 36 is in turn connected with an operating lever 38 pivoted on pin 39. Cooperation between eccentric 22 and lever 38 pulls diaphragm 34 and rod 36 downwardly. The negative pressure created in pump chamber 40 by this action opens valve 30 and draws liquid through conduit 20, inlet 28 and passage 41 from waste holding tank C. A coil spring 42 biases lever 38 counter clockwise about pivot 39, and forces diaphragm 34 and rod 36 upwardly when the low portion of eccentric 22 rotates against lever 38. This upward movement of diaphragm 34 closes valve 30 and opens outlet valve 46 which is normally spring biased to a closed position by spring 47. This action delivers waste liquid through passage 43, outlet 45 and conduit 48 to a float chamber 50 in receptacle 51. Float chamber 50 includes a ball float 52 operatively associated with a needle valve 54 by means of L-shaped bracket 53 pivoted on pin 55 for maintaining liquid level at a predetermined level within float chamber 50. Float chamber 50 includes an outlet metering orifice 60 communicating with an aspirating nozzle 62 positioned in venturi 64 of a carburetion device. For simplicity of illustration, the carburetion device has been illustrated as being an updraft type although it will be appreciated that the present invention is also usable with downdraft types, and other carburetion arrangements such as fuel injection. A needle valve 66 is connected with a bi-metallic snap disc 68, and needle valve 66 normally closes outlet metering orifice 60 so that there is no waste liquid supplied to aspirating nozzle 62. A conduit 72 extends from cooling system water pump 74 on engine E to housing 76 for snap disc 68. Conduit 72 communicates with housing 77 on one side of snap disc 68 and an outlet conduit 78 extends from housing 77 to radiator 80 which holds cooling liquid for engine E. When engine E is up to its desirable operating temperature, such as around 160°F., a thermostat in the cooling system passage opens and pump 74 begins circulating liquid from radiator 80 through the cooling passages

in engine E. This liquid is also circulated through conduit 72 to housing 76 for snap disc 68. Upon reaching a temperature of around 160°F., snap disc 68 moves to the dotted line position shown and needle valve 68 moves downward so that communication is established between aspirating nozzle 62 and the liquid in float chamber 50 through metering orifice 60. It will be recognized that it is also possible to connect housing 76 on one side of bi-metallic disc 68 with a bleed from the exhaust manifold of engine E so that the exhaust gases flowing through housing 76 will operate snap disc 68 to open needle valve 66 when the exhaust gases have reached a desirable operating temperature.

Another float chamber 90 supplies fuel to engine E through aspirating nozzle 92 in a conventional manner. Waste liquid and fuel are fed through intake manifold 94 past inlet valve 96 to combustion chamber 98 of engine E. For a spark ignition engine, a suitable sparking device 102 is provided. The combustion temperature within combustion chamber 98 may be as high as 5,000–6,000°F. and waste liquid or particles fed from waste tank C to combustion chamber 98 is completely burned and vaporized before being exhausted past exhaust valve 104 to exhaust passage 106. The amount of waste liquid fed into combustion chamber 98 through aspirating nozzle 62 varies in accordance with the setting of throttle 112. A conventional reciprocating piston 110 is positioned in combustion chamber 98 and is pivotally connected with crank rod 111 by pin 113.

In accordance with another arrangement, the system of FIG. 3 is connected with exhaust manifold 116 of FIG. 4. Exhaust manifold 116 is connected through suitable headers 118 to a plurality of combustion chambers of engine E. Exhaust manifold 116 may be provided with a venturi throat 120 if so desired although the flow of gas through exhaust manifold 116 is normally sufficient to aspirate liquid through nozzle 62 into the exhaust stream. The exhaust gases from the combustion chambers of engine E are at their highest temperature immediately upon exiting past the outlet valves into exhaust manifold 116, and nozzle 62 is positioned directly in the exhaust manifold where these exhaust gases are at their highest temperature so that liquid fed into the exhaust manifold from holding tank C is substantially burned and vaporized before the exhaust gases lose a substantial amount of their heat during their course of travel through the exhaust system provided.

As is well known, closing of needle valve 54 by operation of float 52 when sufficient liquid is contained in receptacle 51 provides a back pressure sufficient to prevent spring 34 from biasing diaphragm 34 upwardly with sufficient force to open valve 46 against the bias of coil spring 47 and the back pressure existing in conduit 48. Lever 38 then simply reciprocates about pivot 39 relative to rod 36. Once needle valve 54 is opened liquid will again be pumped by reciprocation of diaphragm 34 as the absence of back pressure in conduit 48 will permit spring 37 to bias diaphragm 34 upwardly with sufficient force to open valve 46 against bias of coil spring 47.

In accordance with another arrangement, control means is provided for admitting waste liquid to engine E at a rate which is controlled by the vacuum produced in the inlet manifold of engine E. With reference to FIG. 5, pump D supplies liquid from receptacle C through conduit 48 to another storage receptacle H.

Receptacle H has a discharge conduit 122 leading to an inlet 124 in control device J. Control device J has a liquid discharge outlet 126, and inlet 124 and outlet 126 are normally closed by a reciprocating valve 128 which is biased to a closed position by coil spring 130. Control device J includes upper and lower housing 132 and 134 between which the outer periphery of a flexible diaphragm 136 is secured. The upper end of valve 128 has a threaded shank 138 on which the central portion of diaphragm 136 is retained between a pair of washers 140 by nut 142. Coil spring 130 biases against the upper face of nut 142 to normally hold valve 128 in a downward closed position. An adjusting screw 144 may be provided to vary the force with which spring 130 biases valve 128 downwardly. Below diaphragm 136 bottom housing member 134 is provided with a cavity 146 which communicates with atmosphere through a bleed vent 148. Upper housing half 132 has a cavity 150 which is above diaphragm 136. Conduit 152 establishes communication between cavity 150 above diaphragm 136 and throat 154 of carburetor K above throttle 156 which is pivoted on pin 158. Carburetor K is provided with a fuel float chamber 160 communicating with a fuel supply through conduit 162 in a known manner. A pivoted choke 164 may be provided in carburetor K for operation by control rod 166 in a known manner. Conduit 168 establishes communication between outlet 126 of control device J and an inlet 170 to the upper portion of carburetor K. In operation of the device, the vacuum created in carburetor throat 154 during operation of the engine also causes a vacuum to be formed in chamber 150 above diaphragm 136. This causes diaphragm 136 to move upwardly and draw valve 128 upwardly so that liquid flow of communication is established between inlet 124 and outlet 126 of control device J. Liquid may then flow by gravity from receptacle H through control device J and conduit 168 to inlet 170 in carburetor K. Inlet 170 may contain an atomizing nozzle so that liquid delivered is in the form of a fine spray. Conduit 152 communicates with throat 154 of downdraft carburetor K at a point above throttle 156 so that the vacuum produced in chamber 150 above diaphragm 136 is proportional to the throttle setting and accordingly is also proportional to engine speed. In addition, coasting of the engine at a high speed with throttle 156 closed prevent a vacuum from being created in chamber 150 above diaphragm 136 so that liquid is not fed to carburetor K through inlet 170 when the engine is consuming substantially no fuel. The varying vacuum created in chamber 150 above diaphragm 136 by the variable setting of throttle 150 causes valve 128 to be opened to a degree which is proportional to engine speed so that liquid is metered through control device J into carburetor K at a desired rate which is proportional to engine speed.

In accordance with another arrangement, it is possible to directly control the flow rate of waste liquid in accordance with the setting of the throttle which controls fuel flow. With reference to FIG. 6, a throttle control rod 176 is connected with a lever 178 by suitable connector 180. Lever 178 is connected with pivot 158 of throttle 156 axial pushing and pulling movement of rod 176 causes lever 178 to move in clockwise or counter-clockwise directions to rotate pivot 158 and move throttle 156 to any desired position for operating an engine at a desired speed. A control device M, which is similar to control device J of FIG. 5, is connected by

conduit 180 through a suitable coupling 182 to inlet passage 184 of control device M. Conduit 180 communicates with the bottom of receptacle H as described with reference to FIG. 5. Control device M includes a central bore in which valve 186 is reciprocatingly positioned. The upper portion of valve 186 includes a threaded shank 188 on which a connector 190 is threaded. Connector 190 is pivotally connected to a lever 192 as by screw 194 and lever 192 is attached to lever 178 and pivot 158 for clockwise or counterclockwise movement with lever 178. Control device M includes an outlet 196 connected by suitable coupling 198 with conduit 202 which leads to the upper portion of a carburetion device as described with reference to conduit 168 of FIG. 5. In operation, pivotal movement of throttle 156 to a desired operating position by means of rod 176 and lever 178 also causes vertically upward movement of valve 186 an amount which is proportional to the setting of the throttle. This proportional opening of valve 186 will allow waste liquid to flow from tank H through inlet 184 and outlet 196 of control device M into the carburetor or exhaust manifold of an engine. With this arrangement, the opening of valve 186 meters waste liquid to the engine at a rate which is proportional to the operating speed of the engine. With the arrangement of FIG. 5 or FIG. 6, it will be recognized that it is also possible to have a temperature responsive flow control valve positioned in either conduit 168 or in conduit 202 in a manner described with reference to FIG. 3 so that liquid will not be fed to the engine until it has reached a desired operating temperature.

While the invention has been described with reference to preferred embodiments, it is obvious that modifications and alterations will occur to others upon the reading and understanding of this specification.

Having thus described my invention, I claim:

1. In a system for disposing of liquid and organic human waste material on a human conveyance having a source of motive power defined by a fuel burning engine including an exhaust system for exhausting hot gases therefrom, said engine having throttle means movable to variable positions for varying the rate of fuel flow to said engine and an intake manifold having a variable vacuum therein, said hot exhaust gases, throttle position and manifold vacuum defining variable operating conditions for moving said conveyance under variable operation conditions, sanitary facilities on said conveyance for receiving said waste material, waste tank means for receiving said waste material from said sanitary facilities, flow means including pump means for feeding said waste material from said tank means to said exhaust system for vaporizing and burning said waste material with heat from said hot exhaust gases, and automatic control means for controlling flow of said waste material through said flow means, the improvement comprising; said control means including sensing means for sensing at least two different ones of said operating conditions which together are proportional to the rate at which said engine is consuming fuel

so that waste material is fed through said flow means only when both of said two of said operating conditions are within a range which insures that said engine is consuming fuel at a rate sufficient to produce adequate hot exhaust gases for thoroughly vaporizing and burning said waste material.

2. A method for disposing of liquid and organic human waste material on a conveyance having a source of motive power defined by a fuel burning engine including an exhaust system for exhausting hot gases therefrom, throttle means movable to variable positions for varying the rate of fuel flow to said engine and an intake manifold having a variable vacuum therein, said hot exhaust gases, throttle position and manifold vacuum defining variable operating conditions for moving said conveyance under variable operating conditions, said conveyance including sanitary facilities for receiving said waste material, said sanitary facilities being connected with a waste tank for storing said waste material, said conveyance having flow means including pump means for feeding said waste material from said waste tank to said exhaust system for vaporizing and burning said waste material with heat from hot gases flowing through said exhaust system, comprising the steps of; selectively feeding combustible fuel at selectively variable rates to said engine for operating said engine, exhausting hot gases produced by combustion of fuel in said engine through said exhaust system, automatically monitoring at least two different ones of said operating conditions which together are proportional to the rate at which said engine is consuming fuel, and feeding waste material to said exhaust system only when both of said two monitored operating conditions are within a range indicating that said engine is consuming fuel at a rate sufficient to produce adequate exhaust gases for thoroughly vaporizing and burning said waste material.

3. The system of claim 1 wherein said two operating conditions which are sensed by said sensing means are exhaust gas temperature and manifold vacuum.

4. The system of claim 1 wherein said two operating conditions sensed by said sensing means are exhaust gas temperature and throttle position.

5. The system of claim 1 wherein said two operating conditions sensed by said sensing means are manifold vacuum and throttle position.

6. The method of claim 2 wherein said step of monitoring at least two different ones of said operating conditions includes monitoring exhaust gas temperature and manifold vacuum.

7. The method of claim 2 wherein said step of monitoring at least two different ones of said operating conditions includes monitoring exhaust gas temperature and throttle position.

8. The method of claim 2 wherein said step of monitoring at least two different ones of said operating conditions includes monitoring manifold vacuum and throttle position.

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