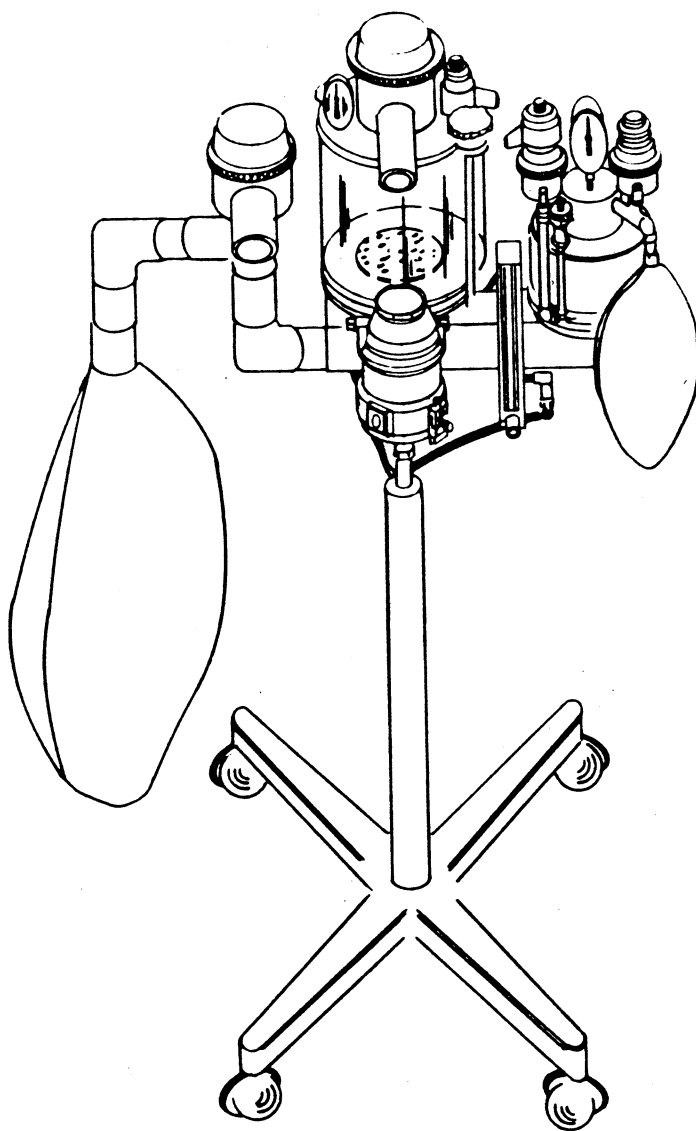


**LARGE ANIMAL ANESTHESIA MACHINE**



Matrx  
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### DELIVERY CHECK-OUT

Examine the shipping carton for signs of external damage. Remove and check the contents of the carton against the shipping label. Inspect for visible damage or missing parts. Immediately notify the dealer if damage is discovered or suspected and/or parts are missing.

### USER RESPONSIBILITY

The VML is designed to perform in accordance with specifications when installed, operated, and maintained as instructed herein. This product must be checked periodically. Defective or worn parts must be replaced immediately. A defective product must not be used. This product should not be repaired other than in accordance with the written instructions provided by Matrix. The user of this product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than Matrix or a Matrix Veterinary Dealer.

### WARNINGS

Do not disconnect a gas supply hose from the machine while it is pressurized as personal injury may occur from hose whip. Always disconnect hoses at gas source first. See Page 14.

Oxygen flowmeter must be open for the nitrous oxide shut-off system to function. Should the oxygen needle valve be turned off, 100% nitrous oxide may be delivered.

### CAUTIONS

Do not invert or tilt a vaporizer that contains anesthetic liquid. See Page 14.

Do not continue to turn the flowmeter knobs after the ball floats are at rest. Continued turning could damage the flowmeters. See Page 15.

Do not overtighten the two knobs on the absorber tie rods--the canister may break. See Page 15.

Do not move the unit by the APL valve or the dome valve--the valves may break. See Page 15.

Open cylinder valve slowly. See page 11.

**DESCRIPTION** (See Page 19 for "Component Identification")

The Matrix Large Animal Anesthesia Machine (VML), is designed for use in large animal anesthesia procedures. The large volume rebreathing circle system features a thirty (30) liter breathing reservoir bag, a 5.2 liter carbon dioxide absorber canister, and a two inch breathing circuit throughout for low resistance to the high flows and volumes encountered in large animal anesthesia.

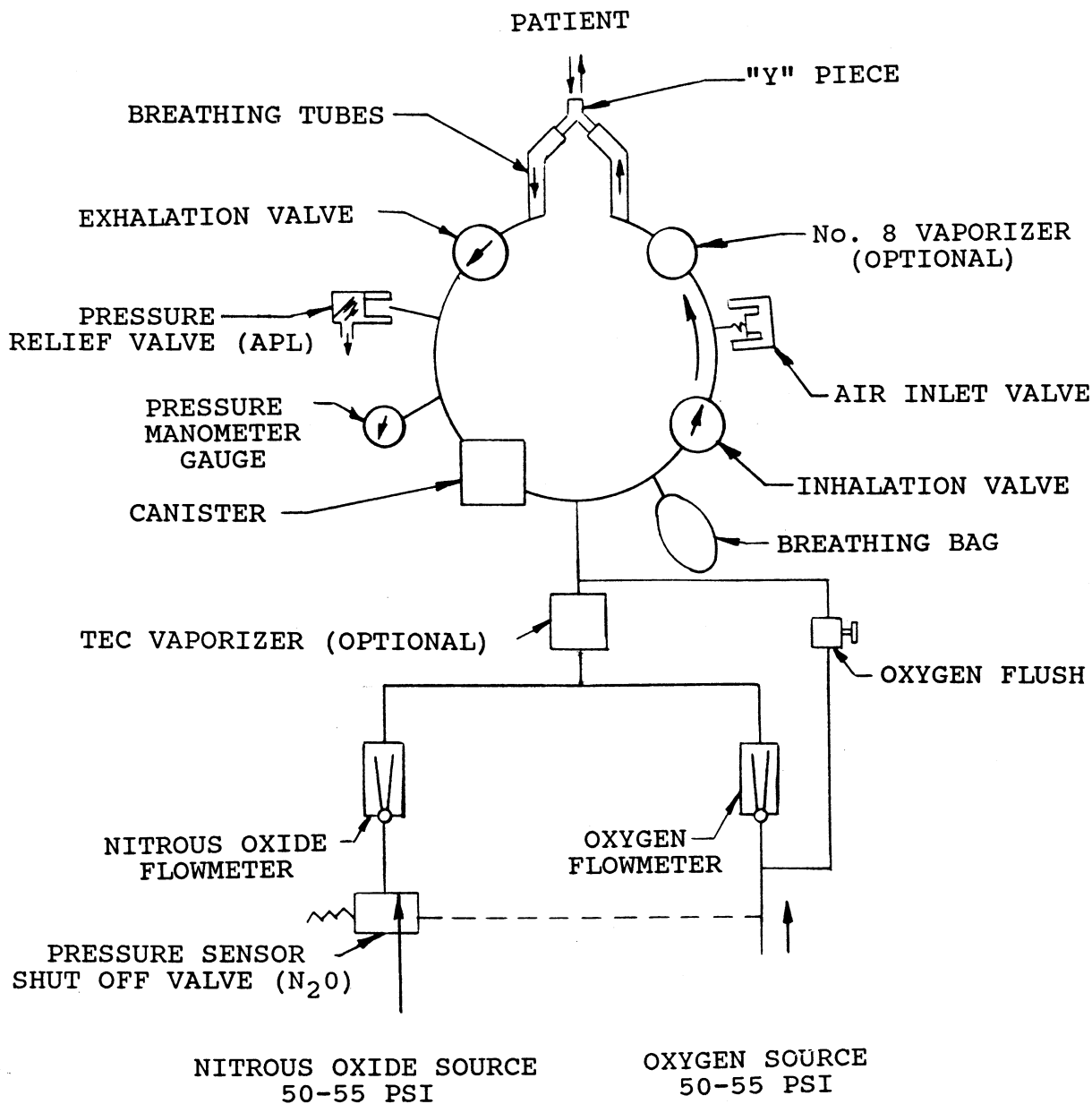


Figure 1 - Pneumatic Schematic

## SYSTEM CONTROLS

- **Flowmeters** - Regulate and monitor the volume of oxygen and nitrous oxide to be delivered into the breathing system. Turn the control knobs clockwise to decrease the flowrate, and turn counterclockwise to increase the flowrate.
- **Oxygen Flush** - Delivers oxygen at a high rate to the patient outlet when the button is depressed.
- **APL Valve** - Manually adjusts the pressure system to the desired level. Turn the control knob clockwise to increase the pressure, and turn counterclockwise to decrease the pressure.

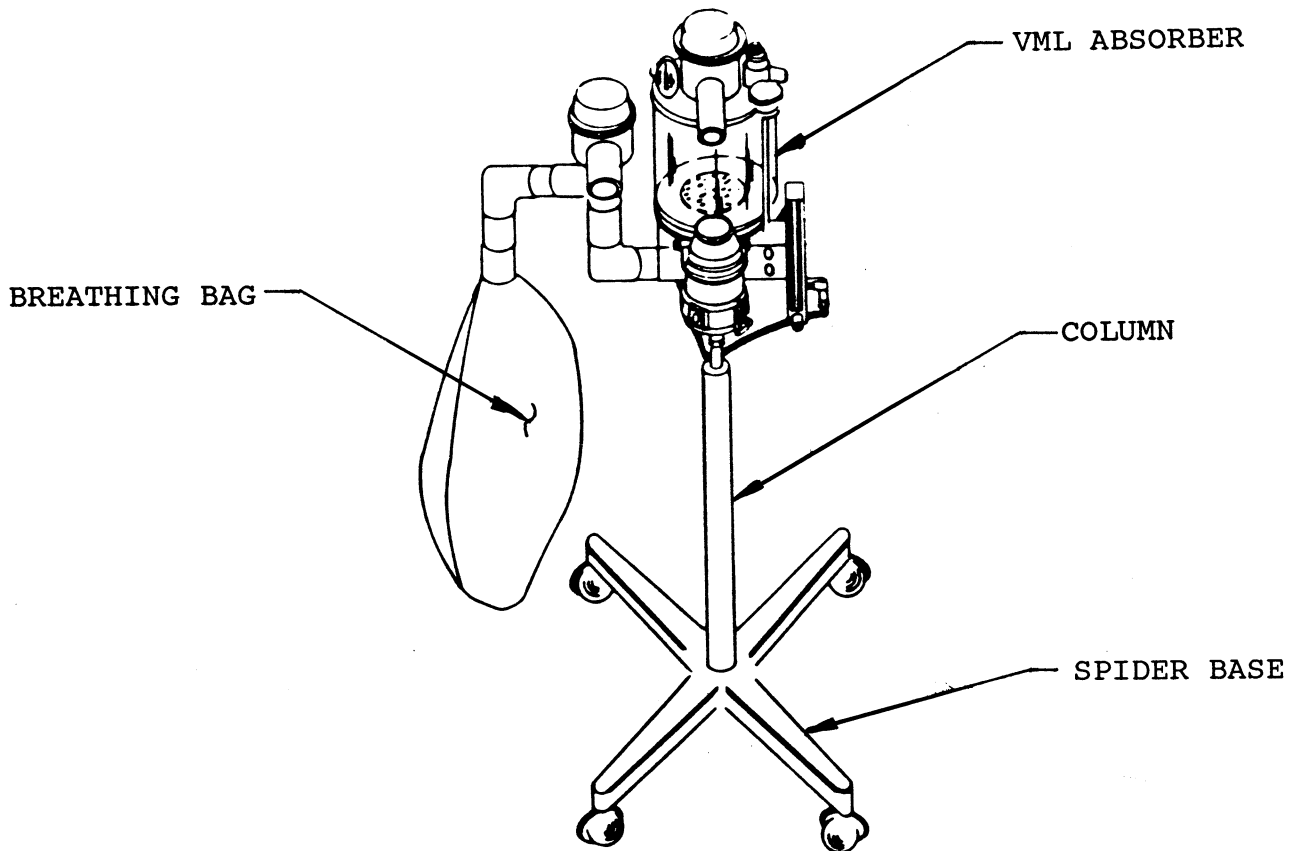


Figure 2 - VML Basic Assembly

**OPTION** - Fluotec Mark III Vaporizer - standard well filler (Halothane), Fluotec Mark III Vaporizer - keyed filler (Halothane), Isotec well fill, Isotec key fill are mounted directly on the mounting bracket.

The output at any given vaporizer dial setting is independent of flowrate, temperature variations, duration of use, and pressure fluctuations due to use of a ventilator.

**OPTION** - The nitrous oxide flowmeter option is mounted to the mounting bracket and includes an oxygen-dependent shut-down circuit. The circuit automatically stops the flow of nitrous oxide in the event of oxygen supply failure. NOTE: See "WARNING" on Page 3.

**OPTION** - The cylinder yoke bracket option is mounted directly to the mounting column to accommodate either size "D" or size "E" cylinders.

**OPTION** - The VMS option is mounted to an extended mounting bracket and features a small animal breathing circuit that includes a 1500ml refillable carbon dioxide absorber canister with directional valves, a pressure manometer gauge, an APL valve, an air intake valve, a two liter breathing bag, and an optional Ayres NRB System.

#### **ASSEMBLY**

1. Insert the tapered end of the stand mounting column into the center hole of the spider base. Push down on the mounting column and twist to secure in place.
2. Align the rear holes of the oxygen flowmeter to the extreme right holes of the mounting bracket (Figures 4, 5, 10).
3. Insert the two socket head screws and turn clockwise to tighten.

## VAPORIZER OPTION KIT

The manual supplied with the vaporizer contains detailed filling and operating instructions. Attach the Tec Vaporizer to the mounting bracket with the FS44 Spacer Kit as described below (Figure 3):

1. Place a washer onto each socket head screw and insert it into the holes in mounting bracket from back side.
2. Place spacers onto each protruding screw. Align the vaporizer with the assembly. Turn the socket head screws clockwise to attach the vaporizer.

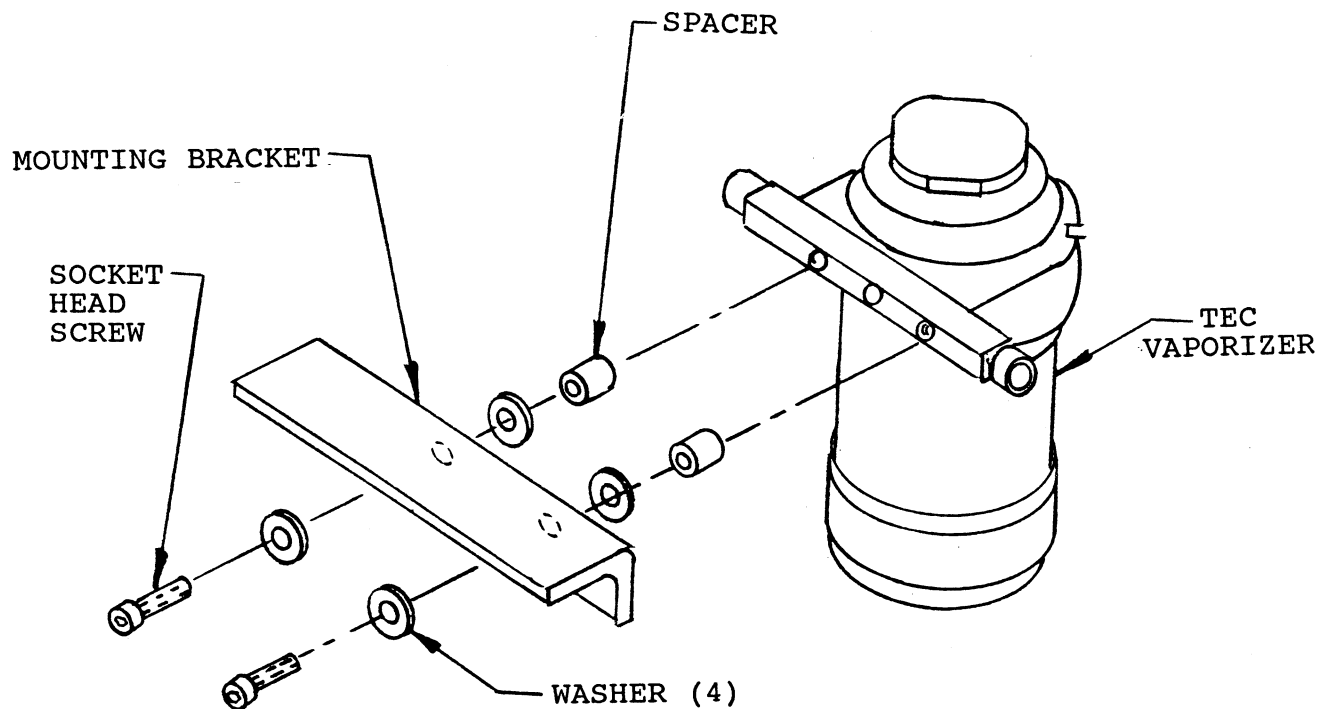


Figure 3 - Tec Vaporizer Assembly

3. Connect the "Y" hose, single end, to the hose barb at the fresh-gas inlet in lower absorber structure (see Figure 5).
4. Connect the hose from "Y" to the barb fitting at oxygen flush.
5. Connect hose from "Y" with FS2 outlet adapter to outlet of vaporizer.
6. Attach hose from flowmeter outlet using the FS2A inlet adapter to vaporizer inlet.
7. Vaporizer may be bypassed by coupling the FS2 and FS2A adapters.

**NITROUS OXIDE OPTION KIT** (See Figures 4, 6)

1. Disconnect the oxygen outlet tube from the barb on the rear of the oxygen flowmeter. Cut two 3-1/2-inch pieces of tube from the outlet end and set both tubes aside to install into optional "Y" piece.
2. Attach nitrous oxide flowmeter to the left of the oxygen flowmeter using the two socket head screws.

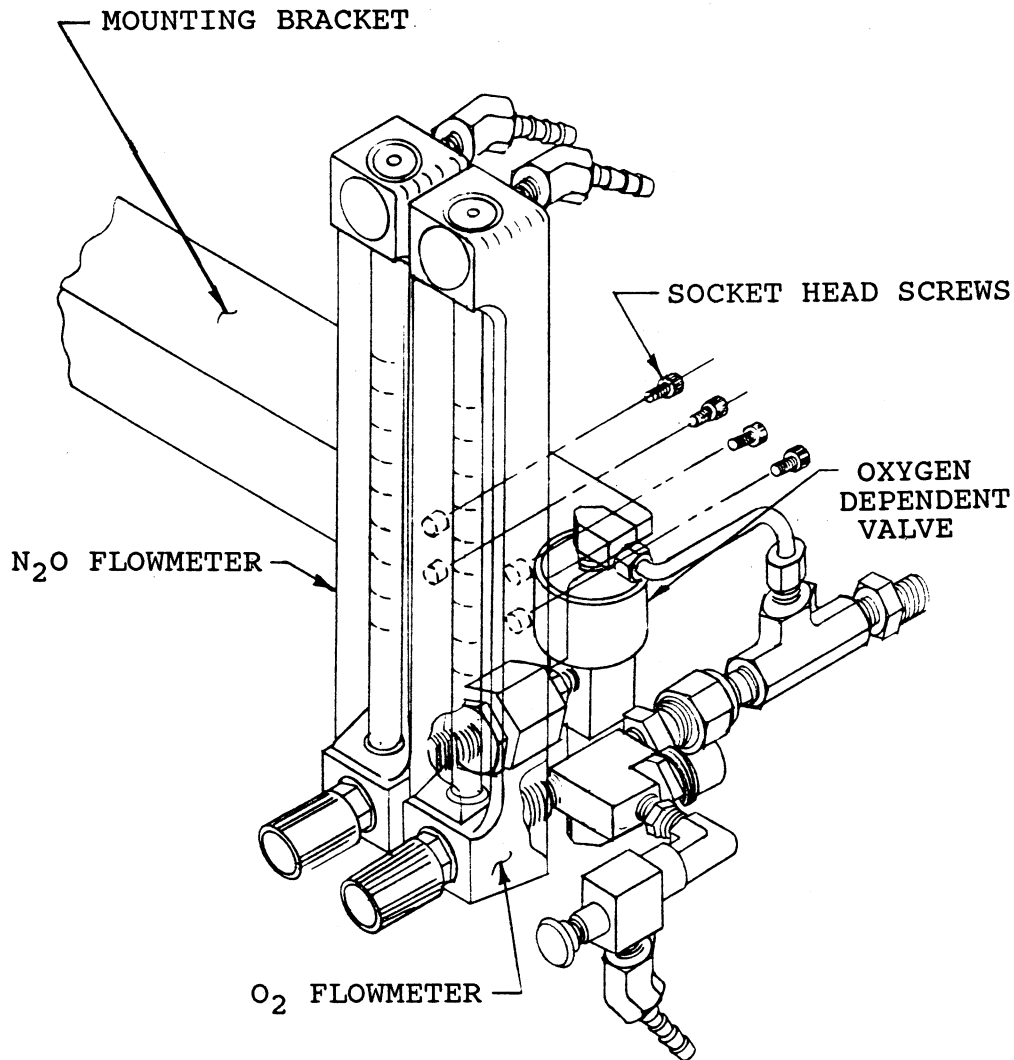


Figure 4 - Nitrous Oxide Flowmeter Option



3. Place the oxygen DISS nut from the oxygen-dependent option to the DISS male on the lower rear of the oxygen flowmeter. Turn the DISS nut clockwise to tighten (see Figure 4).
4. Place the nitrous oxide DISS nut from the oxygen-dependent assembly to the DISS male on the lower rear of the nitrous oxide flowmeter (refer to Figure 4). Turn the DISS nut clockwise to tighten.

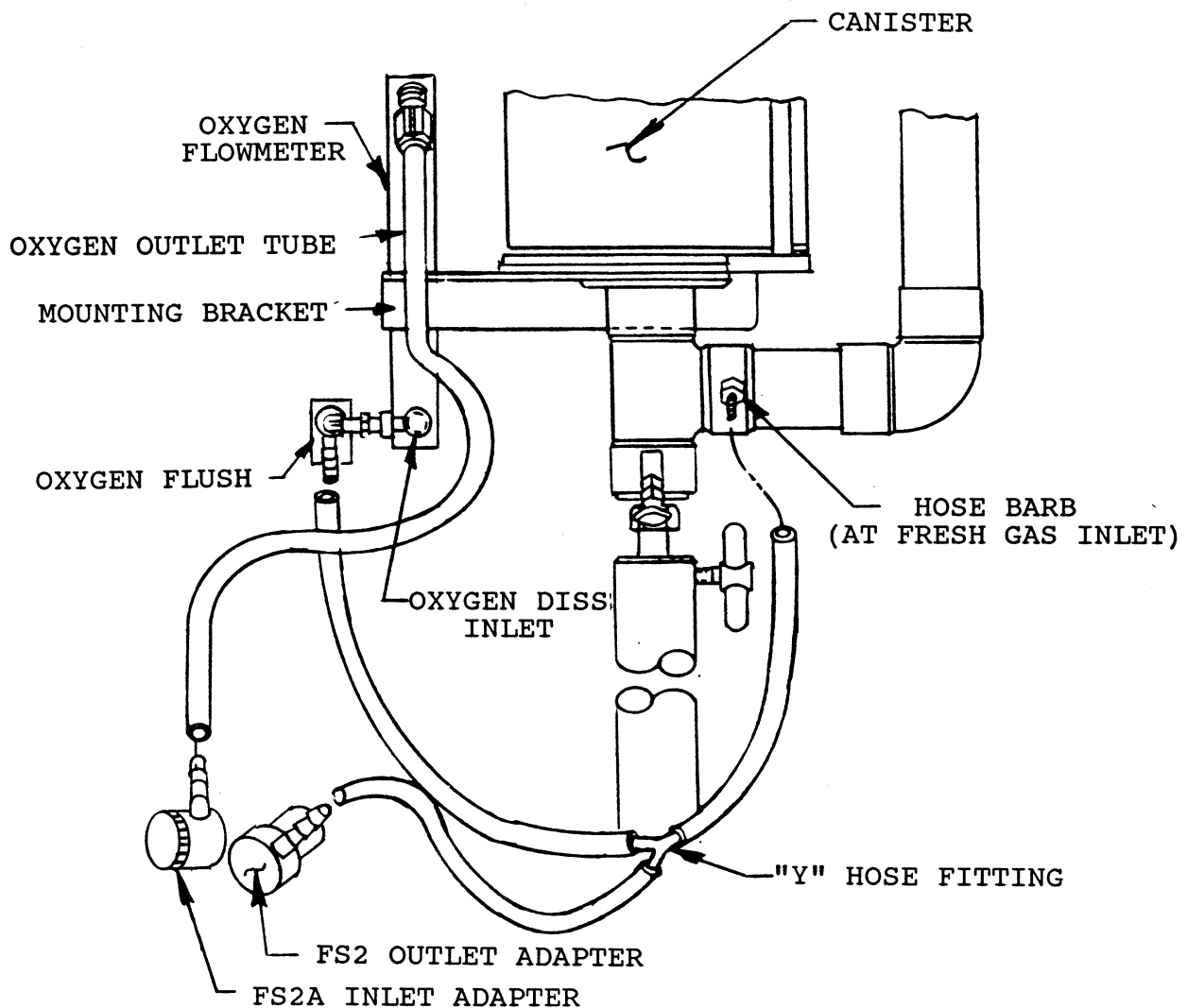


FIGURE 5 - HOSE CONNECTIONS (SINGLE FLOWMETER)

5. Connect the two 3-1/2-inch hoses to the "Y" connector and connect the long hose to the center leg of the "Y" hose (see Figure 6).
6. Push one end of the long tube onto the center leg of the "Y" connector and connect the other tube end to the vaporizer inlet (see Figure 6) using the FS2A inlet Adapter.

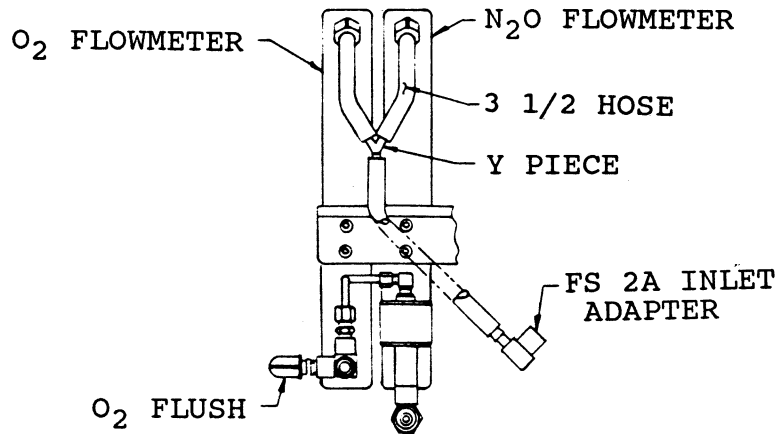


FIGURE 6 - HOSE CONNECTIONS (DUAL FLOWMETER)

7. Push one end of 3-1/2-inch tube onto the oxygen flowmeter outlet (located at top of oxygen flowmeter).
8. Push one end of 3-1/2-inch tube onto the nitrous oxide flowmeter outlet (located at the top of nitrous oxide flowmeter).
9. Connect the FS-2 male outlet to the outlet of the vaporizer.
10. Connect the breathing bag to the breathing bag mount (refer to Figures 2, 10).

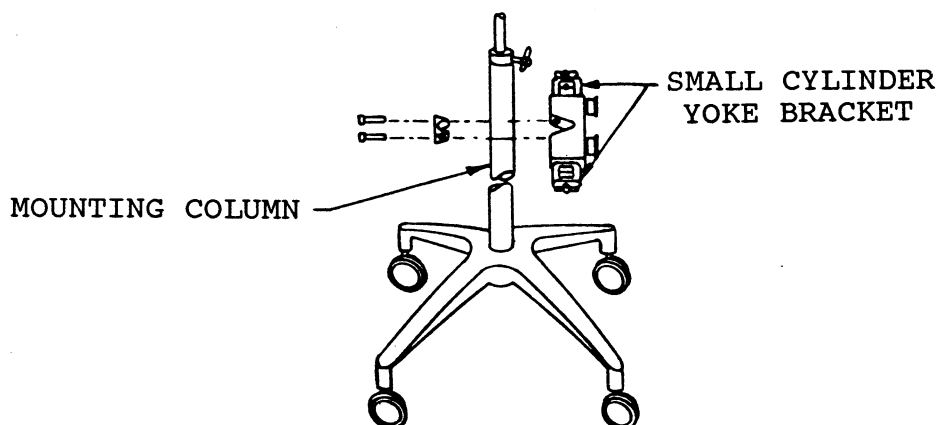


Figure 7 - Cylinder Bracket Assembly

### CYLINDER BRACKET ADD-ON KIT

1. Position the cylinder yoke bracket on the mounting column to (a) match the oxygen bracket side to the oxygen flowmeter flowtube side; (b) position the yoke brackets over the open spaces of the spider base; and (c) hang the yoke brackets a maximum of 29-1/2 inches to a minimum of 29 inches from the floor.
2. Hold the assemblies together with the mount manifold holes aligned to the yoke bracket holes (see Figure 7).
3. Install the two socket head cap screws in the mount manifold and the yoke bracket. Turn clockwise to tighten.

### CYLINDER MOUNTING

1. Turn the tee handle counterclockwise until the point of the tee is flush with the inside of the yoke bar.
2. Remove the seal from the captive strap on the cylinder and discard the strap.
3. Place the center hole of the seal on the center yoke adapter seat. Do not install more than one seal washer per yoke.
4. Place the cylinder directly beneath the yoke bracket with the cylinder port matching the yoke gas adapter.
5. Lift the cylinder through the yoke block with the yoke index pins aligned to the cylinder pin holes and the cylinder port aligned to the yoke adapter.
6. Engage the cylinder to the yoke and hold in position.
7. Turn the cylinder tee handle clockwise until the tee point engages the cylinder.
8. Hand tighten the tee handle. Do not use a tool to tighten the handle.

**CAUTION:** Open cylinder valve slowly.

## VMS ADD-ON KIT

1. Remove the flowmeters and the vaporizer. Set the assemblies aside in an organized arrangement for easy replacement.
2. Turn the acorn nuts in the bottom of the mounting bracket counter clockwise to remove from the bottom of VML absorber plate.
3. Align the new extended, mounting bracket holes to the mounting screws in bottom of absorber plate (see Figures 8 and 11). Attach, using acorn nuts/washers (previously removed), by turning clockwise to tighten.
4. Replace the flowmeter(s) to the appropriate position on the new extended mounting bracket. Place the oxygen flowmeter into the extreme right position on the bracket.
5. Re-install the Tec Vaporizer to the mounting bracket. This vaporizer can be used with the VMS or VML.
6. Insert the screw into the bottom of the VMS absorber and turn clockwise until tight. This screw serves as a mounting stud for the unit.
7. Place the VMS absorber assembly screw into the mounting bracket hole at the end of the extended mounting bracket.
8. Place the lock washer and the acorn nut on the nut screw. Turn the acorn nut clockwise to tighten and secure the VMS absorber to the mounting bracket.
9. Connect the small animal breathing bag to the bag mount outlet.
10. Connect a breathing tube to the inhalation valve and a tube to the exhalation valve. Connect the other ends of the two breathing tubes to the right and left legs of the "Y" connector.

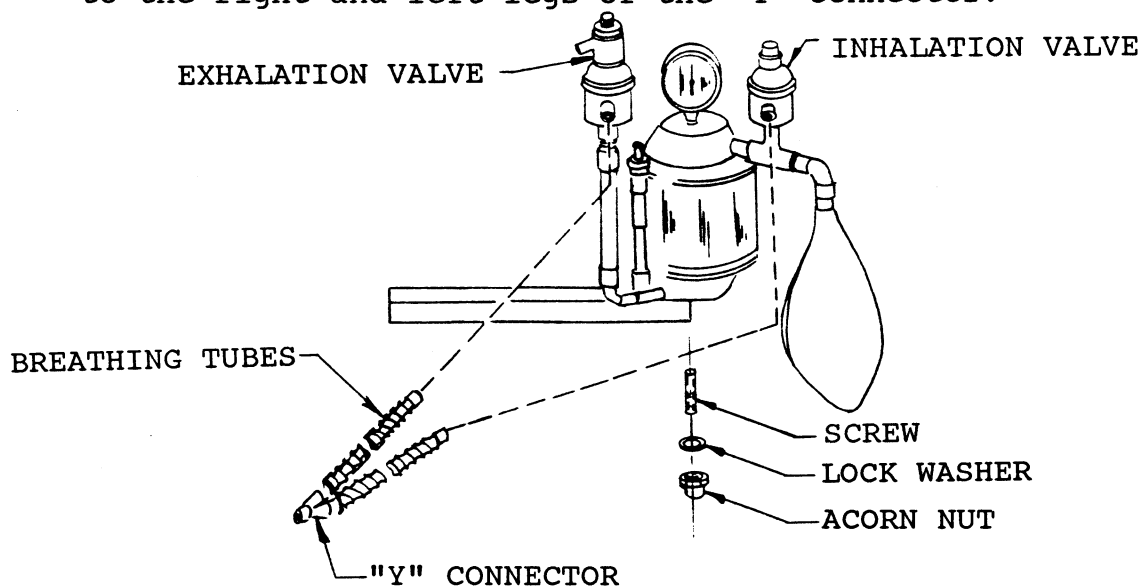


Figure 8 - VMS Assembly

## AYRES NON-REBREATHING OPTION KIT

The oxygen flush valve is inoperative when the Ayres is connected to the system.

Disconnect the outlet adapter from vaporizer and connect the Ayres to the vaporizer (see Figure 9).

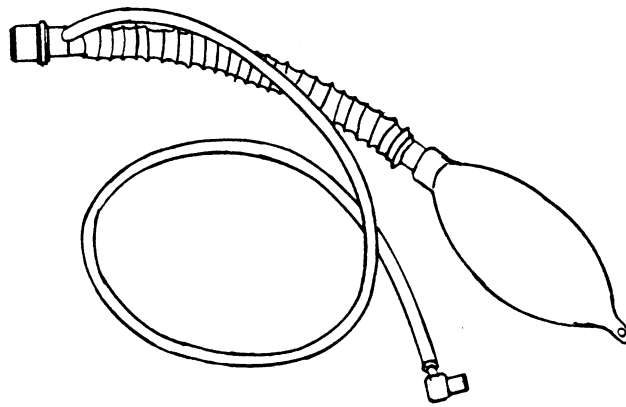


Figure 9 - Ayres Non-Rebreathing Option

## OPERATION

1. Pre-operation check:
  - Adequate gas supplies.
  - Vaporizer filled with agent.
  - Absorber canister filled with fresh absorbent.
  - Oxygen and Nitrous hoses are connected from the 50-55 psi gas source to the flowmeter DISS connectors.

### WARNING

Do not disconnect a gas supply hose from the machine while it is pressurized as personal injury may occur from hose whip. Always disconnect hoses at gas source first.

### CAUTION

Do not invert or tilt a vaporizer that contains anesthetic liquid.

2. Turn ON gas supplies.
3. Adjust oxygen and nitrous oxide (if used) flowmeters to the desired flowrates.
4. Adjust vaporizer setting to the desired concentration.
5. Adjust APL valve dial to the desired system pressure.
6. During anesthesia check:
  - Monitor the breathing bag, the inhalation and exhalation valves, and the pressure gauge(s).
  - Adjust the flowmeter rate(s), the vaporizer setting, and the APL valve to ensure adequate anesthesia.
  - Adjust the flowmeter rate(s) so that the breathing bag does not collapse during inhalation and does not overinflate during exhalation.
7. Post-operative check:
  - Turn OFF the flowmeters by turning knobs clockwise, ONLY until the flowmeter ball floats are at rest on the flow tube stops.
  - Open the valve under the absorber canister to drain the moisture from the canister. Drain the canister at the end of each work period and retighten the valve.

8. Retighten the valve following this procedure.

- Turn OFF the gas supplies at the source at the end of each work period.

**CAUTION**

Do not continue to turn off the flowmeter valve knob(s) after the ball floats are at rest. Continued turning may damage the flowmeters.

**MAINTENANCE**

The system integrity can be maintained with the following routine maintenance procedures:

1. Inspect the machine connections and rubber parts for signs of looseness, damage or wear.
2. Perform functional tests (page 16) and leak check test (page 17) regularly.
3. Clean the unit exterior and the accessories with a glutaraldehyde solution as required. Follow the manufacturer's instructions.
4. Properly discard the remaining anesthetic agent at the end of each week.
5. Change the exhausted absorbent as required. Exhausted absorbent left unused may appear to rejuvenate; however, the color changes quickly when the absorbent is reused.

**ABSORBER CANISTER REFILL**

**CAUTIONS**

Do not overtighten the two knobs on the absorber tie rods--the canister may break.

Do not move the unit by the APL valve or the dome valve--the valves may break.



### **VML CANISTER**

Open the valve at the base of the inhalation leg to drain the absorber canister following each work period. The procedure to open the canister is as follows:

1. Turn the two knobs on the canister tie rods counterclockwise to loosen and remove the canister lid.
2. Raise the canister from the mounting plate and empty the contents.

### **Directions for filling the canister with loose absorbent:**

1. Fill the canister 1/3 full and gently shake the canister to settle the loose absorbent.
2. Fill the canister 2/3 full and repeat the shake.
3. Fill the canister to approximately one inch below the canister top and repeat the shake again.

Reverse the disassembly procedure to replace the canister to the mounting plate. Do not overtighten the two knobs.

### **VMS CANISTER**

Refill the absorber canister as instructed on the decal on exterior of the canister.

### **FUNCTIONAL TESTS**

**VML Inhalation Valve Check** - Inhale from the valve. Unrestricted free flow of air must be observed. Exhale into the valve. No flow must be observed.

**VML Exhalation Valve Check** - Exhale into the valve. Unrestricted free flow of air must be observed. Inhale from the valve. No flow must be observed.

**APL Valve Check** - Connect a single breathing tube between the inhalation and the exhalation valve. Leave the bag on the bag mount. Turn the oxygen flowmeter up to one liter per minute. Monitor the pressure gauge and adjust the APL valve through the full range of settings.

**Flowmeters Check** - Connect the gas supplies and rotate the needle valves to verify that the full range of setting can be obtained.

**Oxygen Flush Check** - Connect the oxygen gas supplies, depress and release the oxygen flush button to verify operation and shutoff.

**Oxygen-dependent Assembly Check-out** - Connect the oxygen gas supplies and turn both flowmeters up to three liters per minute. Turn OFF oxygen at the supply source. Verify that the nitrous oxide flowmeter float falls as the oxygen flowmeter float falls to "0" flow.



## FUNCTIONAL TESTS (Continued)

**VMS Air Inlet Valve Check** - Connect a breathing tube between the exhalation valve and the breathing bag mount. Inhale through the inhalation valve. Air must enter into the system through the air inlet valve.

Connect a breathing tube between the inhalation and the exhalation valves. Exhale into the breathing bag mount. Exhaled air must not escape the system from the air inlet valve.

## LEAK CHECK

Check for leaks at the absorber and the dome assembly gaskets and at the cylinder yoke block and washer:

1. Connect one end of a breathing tube to the inhalation valve and the other tube end to the bag port.
2. Close the APL valve.
3. Press the Oxygen Flush Button until the system pressure is at least 40cm H<sub>2</sub>O, gauge reading.
4. Monitor the pressure gauge. Pressurize to 30cm H<sub>2</sub>O. Monitor the decay drop from 30 to 20cm H<sub>2</sub>O. If more than ten seconds, the absorber is acceptable.

## MANOMETER ADJUSTMENT

1. Turn the bezel counterclockwise to remove the bezel from the gauge.
2. Locate the adjustment screw at "0" on the gauge face.
3. Place a small screwdriver in the adjusting screw slot and turn (a) clockwise to decrease, or (b) counterclockwise to increase. Set adjustment to absolute "0".
4. Replace the bezel to the gauge face and turn clockwise to tighten.

## APL VALVE ADJUSTMENT

The adjustable range of the APL valve is 2cm H<sub>2</sub>O, minimum, and to full gauge setting. The full range is completed in four turns of the valve:

1. Turn the valve knob clockwise to increase the pressure to 50cm H<sub>2</sub>O.
2. Turn the valve knob counterclockwise to decrease the pressure to 2cm H<sub>2</sub>O.

## SERVICE

Service parts and field service capabilities are obtained from your local dealer. Items that cannot be serviced in the field are:

- Vaporizers
- Oxygen Failsafe
- APL Valve

The troubleshooting chart below is helpful in the analysis of service problems. Contact the dealer for necessary service assistance for malfunctions not covered in this section.

Symptom	Possible Cause	Action
Leak test failure	Gross leaks present	Use soapy water solution to check all suspected joints. Tighten connections, repair or replace parts, where necessary.
Flowmeter needle valve will not shut off	Damaged needle and seat	Replace flowmeter needle valve assembly.
Oxygen flush will not shut off	Damaged oxygen flush valve	Replace oxygen flush valve.
Inhalation and exhalation valve fails functional test	a. Warped valve disc	Replace valve disc.
	b. Damaged valve seat	Return absorber for repair.
APL Pressure relief valve inoperative	Defective Relief valve	Return valve for repair.
Failure of oxygen-dependent assembly test	a. Oxygen or nitrous oxide needle valves closed	Open needle valves
	b. Defective failsafe assembly	Replace failsafe assembly.
Air inlet valve inoperative	Defective valve	Replace dome valve assembly.
Unable to achieve maximum flowmeter flow	Supply pressure less than 50-55 psi	Increase supply pressure.
	Flowmeter tube requires cleaning	Clean flowtubes.

Symptom	Possible Cause	Action
Unable to maintain desired level of anesthesia	a. Insufficient flow rate	Increase flowrates.
	b. Carbon dioxide absorbent exhausted	Replace absorbent material.
	c. Vaporizer requires service	Return vaporizer for service.
	d. Machine leaks	Repair leak.
	e. Improper tracheal tube	Replace tube.

### COMPONENT IDENTIFICATION

<u>VML</u> <u>Item No.</u>	<u>Description</u>
1	<b>Inhalation Valve</b> - One-way valve which controls the direction of the fresh gas mixture, recycled gases, and flushed oxygen (flush valve) from the absorber to the patient.
2	<b>Exhalation Valve</b> - One-way valve which controls the direction of expired gases returned to the absorber.
3	<b>Canister</b> - Refillable container for loose carbon dioxide absorbent. Absorbent material removes carbon dioxide from the expired gases before they are recycled back to the system.
4	<b>APL Valve</b> - Manually adjusts the breathing system pressure to the desired level.
5	<b>Pressure Gauge</b> - Monitors the operating pressure in the breathing system as determined by the setting of the APL valve. The gauge scale covers a range of negative pressure from 0 to -60cm of water (left side of scale) and positive pressure from 0 to +60cm of water (right side of scale).
6	<b>Flowmeter Assemblies</b> - Regulate and monitor the volume of oxygen and nitrous oxide flowing into the breathing circuit. The flow tubes incorporate scales graduated in liters per minute and are read by the location of the ball float midline to the scale markings.
7	<b>Oxygen Flush Valve</b> - Depress the Flush button to provide a minimum 60 LPM of oxygen directly to breathing system bypassing the vaporizers. Release the Flush button to shut off the flow automatically.

**VML**  
Item No.

Description

- 8 **Tec Vaporizers** - Controlled method of supplying vaporized anesthetic agents. The dial is graduated in volume/volume basis, thus indicating the percentage of vaporized agents in the gas mixture leaving the vaporizer and entering the breathing system.
- 9 **Breathing Bag Mount** - Provides the method of attachment for the breathing bag.
- 10 **Breathing Bag** - Serves as a gas mixture reservoir in the breathing system to meet inspiratory demands. Inspiratory patterns can be visually monitored, and by squeezing the bag, respiration can be aided.
- 11 **Fresh Gas Connection** - Provides connector for breathing hose attachment to the fresh gas supply.
- 12 **Drain Valve** - Allows removal of condensed water vapor from the absorber canister.
- 13 **Mounting Bracket** - Provides method of flowmeter(s) and vaporizer attachment to the unit.
- 14 **Mounting Column, Spider Base, Casters** - Supports the unit components and enables portability. Locks are provided on two of the casters to provide immobility, when desired.

**VMS**  
Item No.

Description

- 15 **Canister** - Refillable container for loose or pre-packed carbon dioxide absorbent with directional valves. Absorbent material removes carbon dioxide from the expired gases before they are recycled back to the system.
- 16 **Pressure Gauge** - Monitors the operating pressure in the breathing system as determined by the setting of the APL valve. The gauge scale covers a range of negative pressure from 0 to -60cm of water (left side of scale) and positive pressure from 0 to +60cm of water (right side of scale).
- 17 **Air Inlet Valve** - Automatically allows room air into the breathing system in the event that the gases in the breathing bag are depleted. The factory adjusted valve is preset to open at 0.5mm Hg at flowrate of 3 LPM. There are no external adjustments.
- 18 **Breathing Tubes and "Y" Piece** - Method of connecting the patient to the breathing system. The "Y" piece accepts 15mm tracheal tube connectors or animal masks (see Figure 8).
- 19 **Ayres Non-Rebreathing System** - A breathing system designed for use on patients weighting less than 15 pounds (see Figure 9).

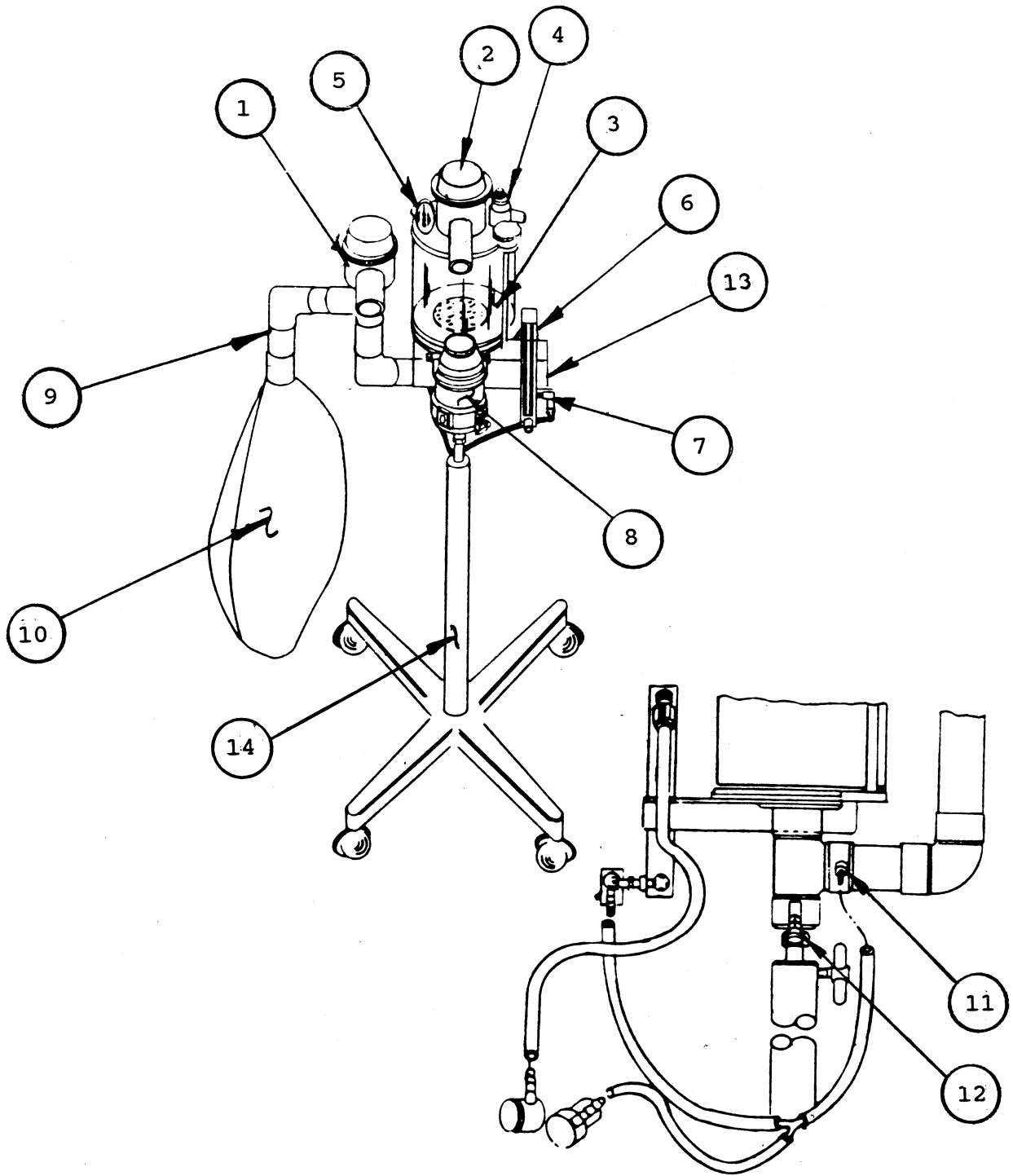


Figure 10 - VML Component Parts

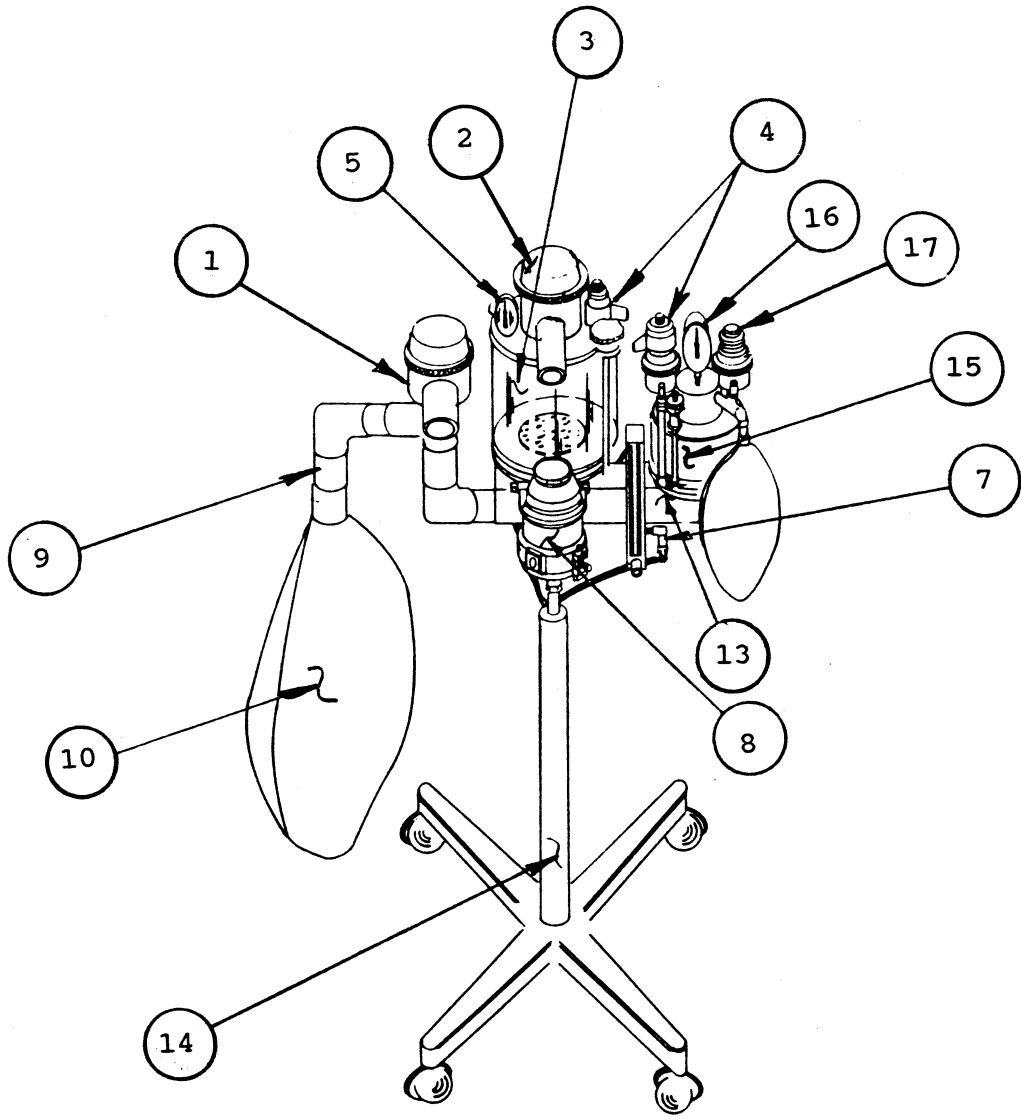


Figure 11 - VML/VMS Component Parts



**PARTS LIST**

Standard VML, w/o vaporizer.....	91802004
VML - 1, w/Fluotec Mark III (Halothane).....	91802001
VML - 5, w/Mark III and Small Animal Breathing Circuit.....	91802005
Nitrous Oxide Flowmeter w/Failsafe.....	94805403
Oxygen Failsafe.....	93805008
Oxygen Flowmeter Assembly.....	93805400
Small Animal Breathing Circuit for VML.....	93300513
Breathing Bag, 30 liter.....	93815400
Oxygen Flowmeter.....	93805400
Exhalation Valve Assembly.....	30028400
Inhalation Valve Assembly.....	30028300
End Plate Assembly - Lower.....	30028200
End Plate Assembly - Upper.....	30028100
Gasket.....	30027600
Mounting Bracket.....	30027400
Tie Rod.....	20047400
Column Assembly.....	20043400
Spacer.....	10050500
Tee Handle.....	10002900
Oxygen-dependent Add-on Assembly - VML & VMS.....	93805008