United States Patent

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[54] **SUPPLY GAS DRIVEN NARCOSIS MIXING APPARATUS**
13 Claims, 1 Drawing Fig.

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[50] **Field of Search** 128/188; 261/35

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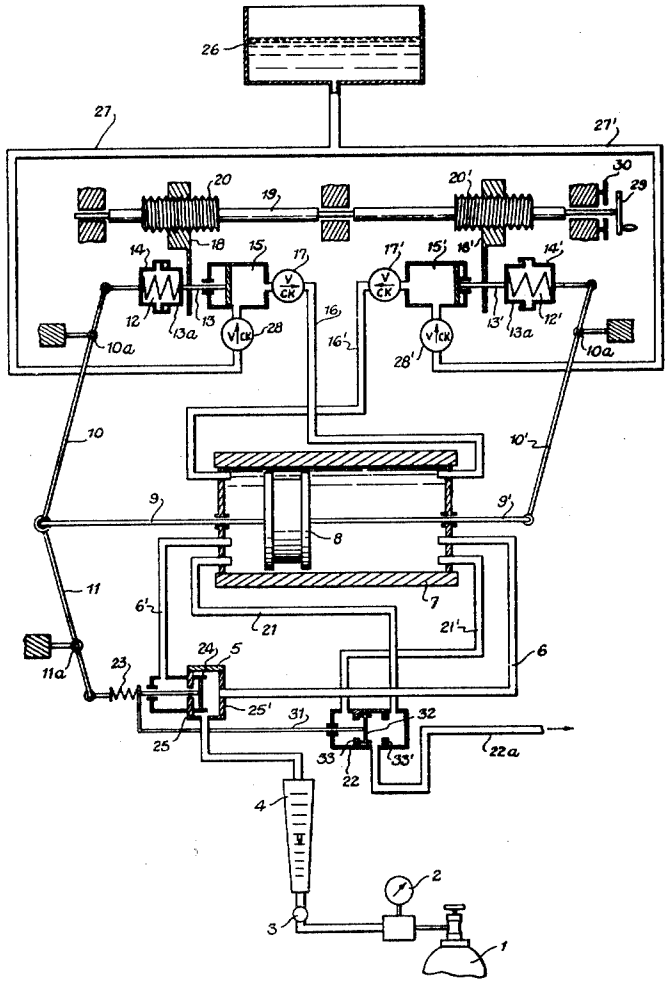
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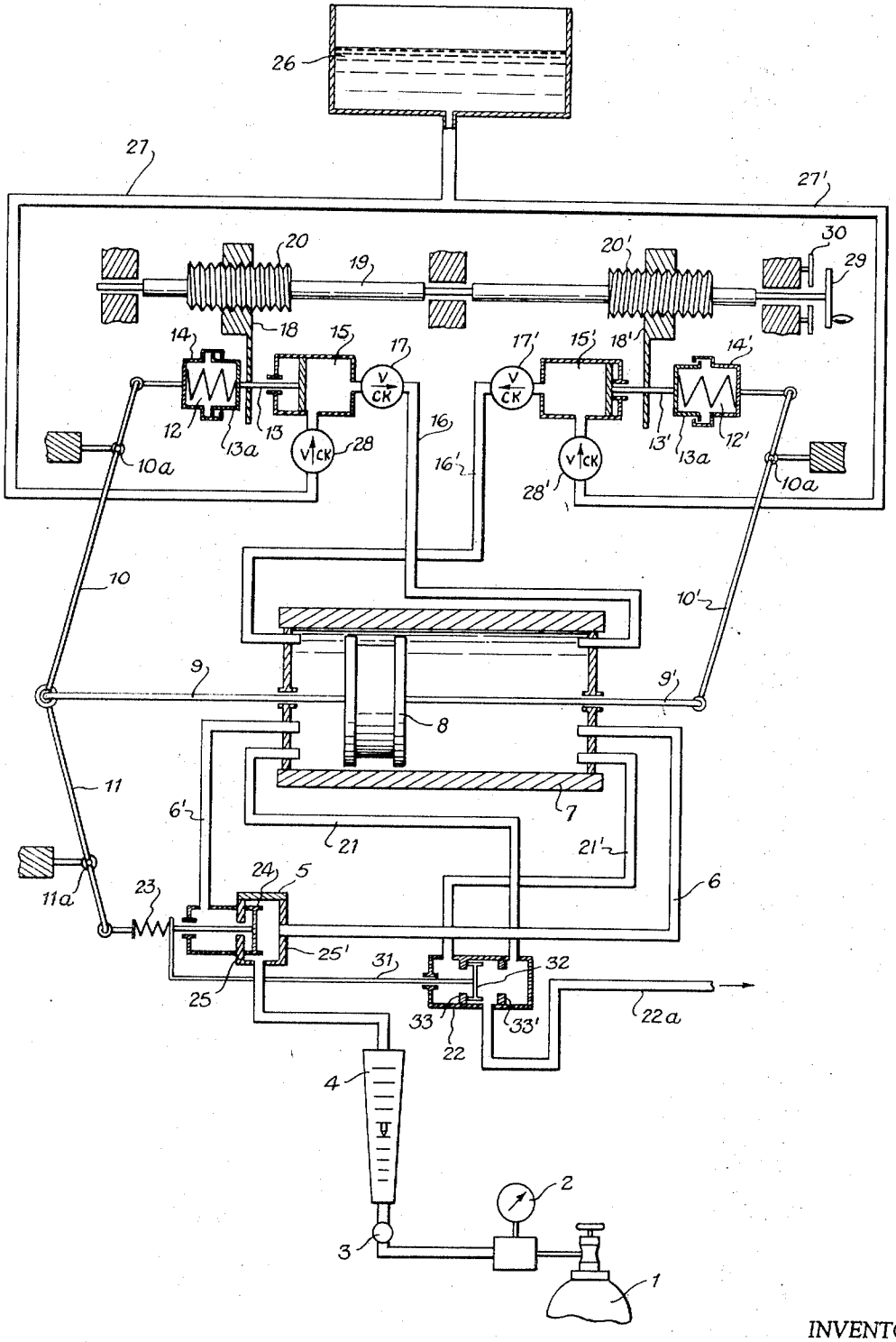
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ABSTRACT: In an anesthesia apparatus, liquid narcosis is mixed with the breathing gas in a metering device. The metering device contains a piston which is driven by the compressed breathing gas, and the metering device further functions as a motor in which the piston drives pumps for forcing the liquid narcosis into the metering device. Finally the piston pumps the admixture of liquid narcosis and breathing gas through a tube leading to a patient.





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SUPPLY GAS DRIVEN NARCOSIS MIXING APPARATUS

The prior art discloses a type of anesthesia vaporizer in which a liquid narcosis is admixed with the nutrient gas supplied to the patient. Such apparatus normally has a surface vaporizer or bubbler in a two-path construction.

On the first path, a portion of the gas flowing to the patient is taken through a vaporizer chamber while a second portion of the gas by-passes the vaporizer chamber.

After flowing through the vaporizer chamber and by-pass, the two portions of the gas stream are again combined. The concentration of the liquid narcosis in the combined mixture is therefore dependent upon the ratio of the size of the partial gas streams and on the vapor pressure of the narcosis in the vapor chamber. By using adjustable throttle valves in the vaporizer chamber circuit and in the by-pass, respectively, it is possible to vary the concentration of the liquid narcosis in the combined mixture.

Such metering devices for adding liquid narcosis to nutrient gas have the disadvantage that the concentration of the liquid vaporized is dependent upon the vapor pressure in the chamber and thus upon the temperature of the liquid. Such disadvantage can be only remedied by employing complicated installation to compensate for temperature changes and requiring the related use of calculating tables or curves. In practice, it has been found that such compensating installations tend to disrupt the operation of the entire apparatus.

Currently used vaporizers have wicks of highly absorbent material for increasing the vaporizing surface. If a different narcosis is to be substituted for one previously used in the vaporizer, then the presence of wicks is a definite disadvantage. When the apparatus is cleaned by draining all of the liquid therefrom, no assurance exists that the liquid narcosis in the wicks is removed. Therefore, during each change-over, it is necessary that the vaporizing chamber be completely dried.

The object of this invention is to avoid the above-mentioned disadvantages. Another object is to produce an apparatus in which it is possible to meter the exact quantity of liquid narcosis to be administered the patient. In this invention, liquid narcosis is mixed with the nutrient or breathing gas by means of one or more pumps for supplying a liquid narcosis to a metering device in which the liquid is mixed with the gas. In this invention, the liquid narcosis is vaporized in the metering device and added to the nutrient gas and accurately metered to the patient.

In this invention, at least one plunger piston pump is connected to the liquid narcosis supply and the amount of liquid pumped can be changed by adjusting the length of the stoke of the piston. The piston stroke is dependent upon the amount of breathing gas flowing to the patient. The liquid narcosis from the pump is introduced into the stream of nutrient gas. The piston stroke is regulated by means of a metering device functioning as a motor and containing a double-acting piston driven by the pressure of the nutrient gas.

The means by which the objects of the invention are obtained are described more fully with reference to the accompanying schematic drawing showing a cross-sectional view through parts of the apparatus.

The nutrient gas supply from compressed gas tank **1** flows through a reducing valve **2**, control valve **3** and volume measuring meter **4** into the reversing inlet valve **5**. In the valve position shown, the gas flows further through pipe **6** to the righthand cylinder space of metering device cyliner **7**. The pressure of the gas moves the double-acting piston to the left. Connecting rod **9** joined to the piston is likewise moved. Rod **9** is connected to lever **10** which pivots on a fulcrum **10***a* and which is further joined to a lever **11** which pivots on a fulcrum **11***a*.

A spring **12** connects lever **10** to plunger piston rod **13**. Spring **12** is contained in an extensible telescopic housing **14**. The maximum expansion of spring **12** is limited by housing **14**. The described movement of rod **9** to the left moves spring housing **14** to the right and forces the plunger piston to the right. The plunger piston in cylinder **15** is filled with liquid narcosis and movement of the piston forces liquid narcosis through pipe **16** containing check valve **17** into cylinder **7** where the liquid narcosis evaporates and mixes with the nutrient gas. Depending upon the concentration desired in the nutrient gas, the stroke of piston rod **13** is adjustable by means of stop **18** which is engageable with spring housing portion **14***a*.

A corresponding system on the righthand side of the drawing alternately furnishes liquid narcosis to the lefthand cylinder space in cylinder **7** by means of the piston rod **9'**, lever **10'**, spring **12'**, piston rod **13'**, housing **14'**, cylinder **15'** and pipe **16'** containing check valve **17'**.

The stops **18** and **18'** are connected to a shaft **19** whose threads **20** and **20'**, respectively, are reversely pitched. The narcosis and gas mixture just formed in the lefthand side cylinder space of cylinder **7** is forced by movement of piston **8** to the left through pipe **21** and outlet valve **22** through tube **22***a* leading to the patient.

Lever **11** joined to rod **9** has its other end connected to a spring **23***a* which joins a valve head **24** in the reversing inlet valve **5**. It is also joined by rod **31** to the valve head **32** in the outlet valve **22**. The two valve seats **25** and **25'** of the inlet valve **5** are composed of annular magnets.

If the force of spring **23** under the pressure of the lever **11** exceeds the holding force of magnetic valve seat **25**, then both valve head **24** and valve head **32** are moved to the opposite valve seats **25'** and **33'**, respectively.

The gas flowing from compressed gas tank **1** and passing through reducing valve **2**, control valve **3** and meter **4**, now moves through pipe **6'** to the left cylinder space in cylinder **7**. This starts the alternate operation of the apparatus.

The plunger piston rod **13** in cylinder **15** is now moved to the left to a position starting a new cycle. This liquid narcosis can flow from container **26** through pipe **27** and check valve **28** into cylinder **15**.

The shaft **19** is connected to a control knob **29** which has its associated scale **30**. This scale can be exchanged for a scale made for a different type of narcotic to be dispensed by the same apparatus.

I claim:

1. An apparatus for admixing liquid narcosis with the breathing gas fed to a patient comprising a breathing gas supply, a liquid narcosis supply, a breathing gas and liquid mixing and metering device including a motor driven by said gas supply, composed of a cylinder and a piston slidable in said cylinder, an inlet gas control valve mounted between said gas supply and said cylinder, means joining said piston to said inlet control valve for actuating said control valve, pump means joined to said narcosis supply for forcing liquid narcosis into said cylinder, connecting means joining said piston to said pump means for driving said pump means, and tube means for conducting gas from said metering device to a patient.

2. An apparatus as in claim **1**, said piston being a double-acting piston movable in two cylinder spaces in said cylinder, and each of said cylinder spaces being connected to said inlet control valve.

3. An apparatus as in claim **2** further comprising an outlet control valve joined between each of said cylinder spaces and said tube means for conducting gas to a patient.

4. An apparatus as in claim **3**, each inlet valve and outlet valve, respectively, being a reversing valve and comprising a valve head seatable on valve seats disposed on opposite sides of the valve head.

5. An apparatus as in claim **4**, at least one of said inlet valve and said outlet valve comprising a magnetic valve having annular magnetic valve seats.

6. An apparatus as in claim **5**, said connecting means joining said motor to said pump means comprising a mechanical connection.

7. An apparatus as in claim **6**, said pump means comprising a plunger piston pump, said mechanical connection including spring means in the drive for the plunger piston pump, and adjustable stop means for limiting the action of said spring means.

8. An apparatus as in claim 7, further comprising shaft means joined to said stop means for adjusting the position of said stop means.

9. An apparatus as in claim 8, further comprising scale means associated with said shaft means for indicating the amount of liquid narcosis pumped by said piston plunger pump.

10. An apparatus as in claim 9, said scale means being exchangeable.

11. An apparatus as in claim 10, said spring means comprising a spring, and spring housing means for restricting the maximum expansion of said spring.

12. An apparatus as in claim 11, further comprising check valve means interposed between said plunger piston pump and said metering device cylinder.

13. An apparatus as in claim 12, said mechanical connection joining said motor to said plunger piston pump comprising a double lever which also comprises said means for joining said metering device piston to said inlet valve.