

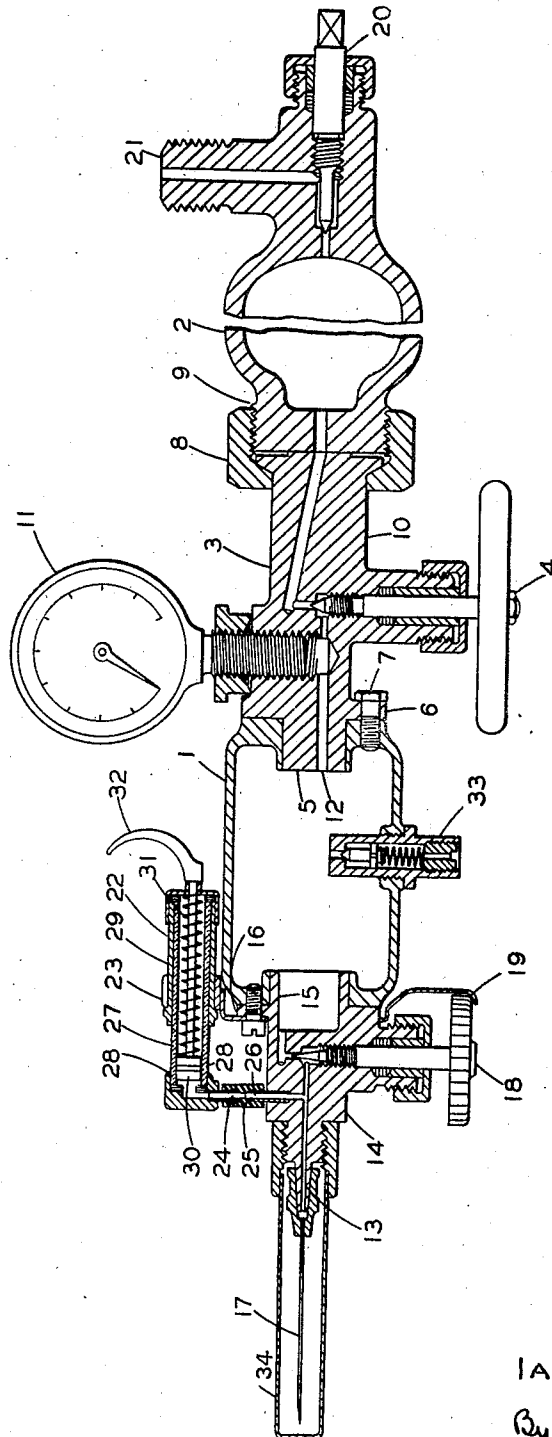
Dec. 21, 1943.

I. McPHERSON

2,337,347

APPARATUS FOR THE HYPODERMIC ADMINISTRATION OF GAS

Filed May 19, 1942



INVENTOR  
IAN McPHERSON

By *Oldham*  
his ATT'Y.

## UNITED STATES PATENT OFFICE

2,337,347

APPARATUS FOR THE HYPODERMIC  
ADMINISTRATION OF GAS

Ian McPherson, London, England

Application May 19, 1942, Serial No. 443,603  
In Great Britain May 19, 1941

7 Claims. (Cl. 128—184)

In the treatment of certain diseases and injuries the administration of oxygen is known to be beneficial. Nevertheless circumstances often arise in which oxygen treatment by the ordinary inhalation methods is inconvenient or impossible. For instance in cases of asphyxia the lungs may be incapable of absorbing oxygen at the necessary rate, and in first aid treatment the patient may be so situated that oxygen inhalation apparatus, even if available, cannot be used.

Oxygen can also be administered beneficially by hypodermic injection, and this mode is a valuable alternative in cases where inhalation is unsatisfactory or impracticable. When oxygen is administered by hypodermic injection it is very desirable that the dose should be measured fairly accurately and that the rate of injection should be capable of easy regulation so as on the one hand not to waste time and on the other hand to allow substantially all the oxygen injected into the tissues to become dispersed.

An object of the present invention is to provide apparatus for the hypodermic injection of gas, for example, oxygen, which is capable of administering accurately measured doses, at any desired rate, and which is nevertheless simple to operate, readily portable, robust, and reasonably cheap to manufacture.

Another object is to provide such apparatus which is capable of being charged from standard commercial oxygen cylinders at the pressures usually employed, namely up to 120 atmospheres, and of delivering gas to the patient as slowly as desired, and which nevertheless does not call for the use of automatic pressure-reducing valves.

Further objects and advantages of this invention will become apparent from the following description of an embodiment thereof given by way of example with reference to the accompanying diagrammatic drawing, which is a sectional side elevation of the improved apparatus designed for the hypodermic injection of oxygen.

This apparatus includes a working chamber adapted to contain a therapeutic dose of oxygen, i. e. between 200 and 500 cubic centimeters, at a pressure of between 2 and 10 atmospheres, a needle mount communicating with the working chamber through a regulating valve capable of fine adjustment, a pressure gauge arranged to indicate the pressure in the working chamber, a high-pressure reservoir chamber communicating with the working chamber through a supply valve, and means for admitting gas to the reservoir chamber. The working chamber 1 and the

reservoir chamber 2 are cylindrical and coaxial, being connected together by a neck portion 3 which includes the supply valve 4 for controlling the flow of oxygen from the reservoir chamber to the working chamber. The neck portion has a spigot 5 accommodated in a central hole in the end of the shell of the working chamber 1 and a flange 6 secured by screws such as 7 to a facing on this shell. The neck portion 3 is secured to the shell of the reservoir chamber 2 by a union comprising an internally flanged nut 8 engaged on a flanged stem 10 of the neck portion and screwed on a threaded end portion 9 of the shell. The supply valve 4 is of the needle type such as is commonly used in oxygen apparatus, being capable of fine regulation.

A pressure gauge 11 is attached to the neck portion 3, communicating with a delivery duct 12 leading from the valve 4 to the working chamber 1.

A needle mount 13 is formed on the end of a regulating valve body 14 secured by a joint comprising a spigot 15 and a flange 16 to the shell of the working chamber 1, the needle 17 being coaxial with the chambers 1 and 2. The regulating valve 18, which controls the flow of oxygen from the working chamber 1 to the needle 17, is also a needle valve capable of fine regulation. Its operating disk is graduated and co-operates with a fixed pointer 19. A safety valve 33 is provided in the working chamber 1. The needle mount is provided with a screwed protector cap 34 adapted to contain a disinfectant wad.

Means for charging the apparatus with oxygen consist of a needle valve 20 accommodated in the other end of the shell of the reservoir chamber 2, this valve controlling a passage between a union 21 and the reservoir chamber.

A syringe 22 is secured by a clip 23 alongside the working chamber. The nozzle 24 of this syringe is connected, for instance by a rubber union sleeve 25, to a pipe 26 branching from the duct leading from the regulating valve 18 to the needle 17. The syringe has a transparent barrel 27 visible through ports 28 in the barrel casing 29. The plunger 30 of the syringe is loaded by a compression spring 31 and can be withdrawn with the aid of a finger hook 32.

The apparatus is used as follows. It is connected to a cylinder of oxygen through the union 21 and an adaptor (not shown) which includes a filter. The supply valve 4 and the regulating valve 18 are shut, and the charging valve 20 is opened. Gas is then admitted under control of the cylinder valve. When the reservoir 2 is

charged, the cylinder valve and the charging valve 20 are shut, and the apparatus is disconnected at the union 21. The reservoir chamber may be charged with gas at the full cylinder pressure, say 120 atmospheres. It will be assumed that the working chamber 1 contains only oxygen at atmospheric pressure. The supply valve is now opened slightly in order to charge the working chamber with oxygen at a higher pressure. The pressure gauge 11 may be calibrated to indicate the equivalent volume in cubic cm. at atmospheric pressure of the dose of oxygen capable of being discharged from the working chamber 1, i. e. the equivalent volume at atmospheric pressure of the gas compressed in the working chamber minus the volume of the working chamber. The volume of the working chamber may be such that a dose of 300 cc. of free oxygen corresponds to a gauge pressure of say 60 lbs. per sq. in. When a little more than the desired dose of gas, as shown by the gauge, has entered the working chamber 1, the supply valve 4 is shut and the regulating valve 13 is opened until the pressure-gauge hand drops to the volume indication of the desired dose, the surplus gas being blown through the needle to waste. The apparatus is then ready for administering the dose to the patient. The safety valve 33 is set to blow off at such a pressure as to protect the gauge 11 from damage if the supply valve 4 is left open too long.

After the needle 17 has been inserted into the patient, it is desirable to ascertain whether the needle projects into a vein. If it does, there is a risk of gas embolism. Accordingly, the plunger 30 of the syringe 22 is pulled by the hook 32. If the needle is in a vein, blood is drawn up and is seen in the transparent barrel 27. If however no blood appears and resistance is felt to withdrawal of the plunger, the administration of oxygen can be begun. The injection process normally takes a few minutes, and during this time the operator gradually opens the regulating valve 18 as the pressure in the working chamber 1 falls, so as to maintain a more or less uniform flow of gas. The operation is completed when the gauge hand indicates zero. The regulating valve 18 is now shut again, and the working chamber is ready to be recharged to the desired dose from the reservoir chamber 2 by manipulating the charging valve 4. A convenient size of reservoir chamber is about 180 cubic centimetres.

I claim:

1. Apparatus for the hypodermic injection of gas, including a working chamber capable of containing a therapeutic dose of gas at a pressure of a few atmospheres, a needle mount communicating with said working chamber and including a regulating valve capable of fine adjustment, a pressure gauge arranged to respond to the fluid pressure in said working chamber and thereby enable the amount of said dose to be ascertained, a high-pressure reservoir chamber capable of containing a plurality of such doses, a manually controllable stop valve capable of fine adjustment and serving as the sole means for controlling the flow of gas from said reservoir chamber and said working chamber, and means for admitting gas to said reservoir chamber.

2. Apparatus for the hypodermic injection of gas, including a working chamber capable of containing a therapeutic dose of gas at a pressure of a few atmospheres, a needle mount communicating with said working chamber and including a regulating valve capable of fine adjustment, a pressure gauge arranged to respond to the fluid

pressure in said working chamber and thereby enable the amount of said dose to be ascertained, a high-pressure reservoir chamber capable of containing a plurality of such doses, a manually controllable stop valve capable of fine adjustment and serving as the sole means for controlling the flow of gas from said reservoir chamber and said working chamber, a charging union associated with said reservoir chamber, and a controllable stop valve between said union and said reservoir chamber.

3. Apparatus for the hypodermic injection of gas, including a working chamber, a needle mount communicating with said working chamber and including a regulating valve, a pressure gauge arranged to respond to the fluid pressure in said working chamber, a reservoir chamber, a supply valve for controlling communication between said working chamber and said reservoir chamber, means for admitting gas to said reservoir chamber, and a syringe communicating with the duct through said needle mount on the needle side of said regulating valve, at least part of the fluid tract of said syringe being transparent.

4. Apparatus for the hypodermic injection of gas, including a needle, a needle mount, a working chamber, a connecting element and a reservoir chamber disposed in line in the order stated, a regulating valve in said needle mount, a suction duct branching from the duct from said working chamber through said needle mount to said needle and on the needle side of said valve, a supply valve in said connecting element controlling the duct therein between said chambers, a pressure gauge mounted on said connecting element and communicating with said last-mentioned duct between said supply valve and said reservoir chamber, and a valve-controlled charging union on said reservoir chamber.

5. Apparatus for the hypodermic injection of oxygen, including a working chamber capable of containing at a pressure of between 2 and 10 atmospheres a dose of oxygen equivalent to between 200 and 500 cubic centimeters at atmospheric pressure, a needle mount communicating with said working chamber and including a regulating valve capable of fine adjustment, a pressure gauge arranged to respond to the fluid pressure in said working chamber, a safety valve communicating with said working chamber and set to blow off at a pressure such as to protect said gauge from damage, a reservoir chamber capable of containing a plurality of such doses of oxygen at a pressure of the order of 100 atmospheres, a manually controllable supply valve capable of fine adjustment and serving as the sole means for controlling communication between said working chamber and said reservoir chamber, a charging union for admitting gas to said reservoir chamber and a controllable stop valve between said union and said reservoir chamber.

6. In an apparatus for the hypodermic injection of gas, including a working chamber, a needle mount communicating with said working chamber through a regulating valve, a pressure gauge arranged to respond to the fluid pressure in said working chamber, a reservoir chamber, and a supply valve for controlling communication between said working chamber and said reservoir chamber, the provision of means communicating with the duct through said needle mount for extracting fluid from said duct on the needle side of said regulating valve.

7. Apparatus for the hypodermic injection of gas including a needle mount, a working chamber,

a supply connection and a reservoir chamber rigidly connected together in line in the order stated, said needle mount including a stop valve capable of fine adjustment for regulating a needle supply duct communicating with said working chamber, said working chamber being capable of containing a therapeutic dose of gas at a pressure of between 2 and 10 atmospheres, said supply connection including a manually-controllable supply valve which is capable of fine adjustment and which is the sole means for controlling the flow of gas from said reservoir chamber to said work-

5 ing chamber, said reservoir chamber being capable of containing a plurality of such doses of gas at a pressure of the order of 100 atmospheres, and said apparatus also including a pressure gauge communicating with said working chamber, a safety valve connected to limit pressure in said working chamber to a value such that said gauge is protected from damage, and a charging union for admitting gas to said reservoir and  
10 including a stop valve.

IAN McPHERSON.