

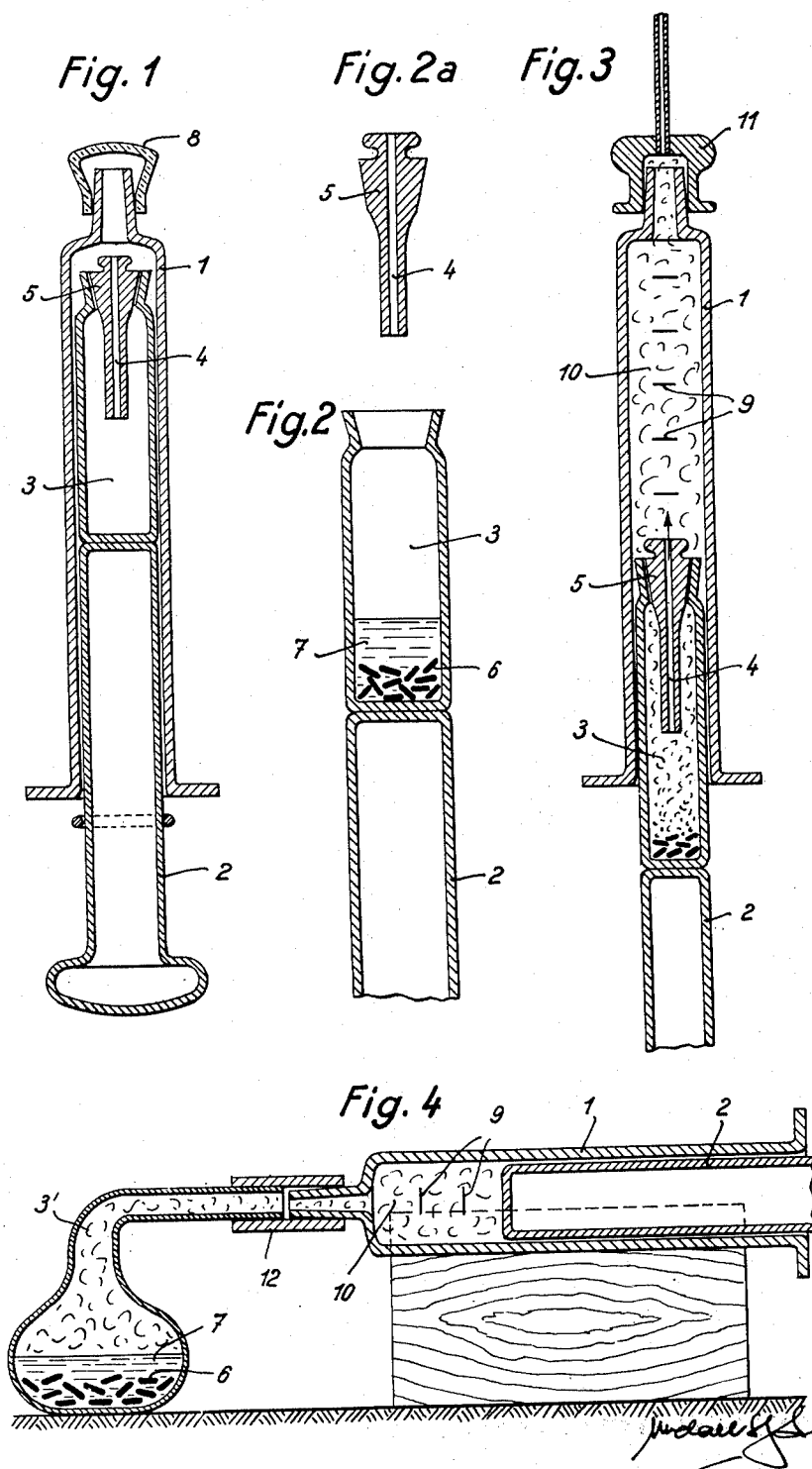
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SYRINGE FOR GAS INJECTIONS

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SYRINGE FOR GAS INJECTIONS

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The present invention relates to a novel method for the generation of gas for medical purposes and to a syringe for the application of the generated gas.

In medicine the use of gas for therapeutic purposes has become a well-known practice, whereby in many cases the application of the gas is effected by means of a syringe. The syringes which have been used hitherto have been filled with the gas in exactly the same way as an ordinary squirt or syringe is filled with liquid. That is to say, the syringe had to be connected to a storage tank for the gas, whereupon the gas was sucked into the syringe through backward pulling of the piston. The syringe can then be employed in the customary fashion, or pushed into an infiltration cannula and applied that way.

However, this known method of applying the gas has serious disadvantages, as it makes a control, both as regards the quantity and quality of the gas, well-nigh impossible. But for medical purposes a control of this kind appears to be of greatest value, so that a careful application of the gas is absolutely necessary. Furthermore, the possibility of strictest control is a condition for scientific research work regarding the result of such gas treatments, considering that in work of this kind it has to be accurately determined in what condition, composition, concentration and at what pressure and temperature a definitely defined quantity of gas has been applied, as the correct ascertainment of all of these values is of utmost importance for the treatment and its controllable result. For gas-syringes of the known type a controlling possibility like this does practically not exist. Already when a syringe is being filled with the gas from a storage tank there never seems to be an absolute certainty that the gas in the tank is actually the one that is needed, and even less certainty exists regarding the condition of the gas in physical and chemical respects. Still another factor of uncertainty resides in the possibility that air may be admitted into the syringe while the latter is being charged with the gas.

In the present invention all of these deficiencies are overcome in a simple and absolutely reliable way. According to the invention the chemical substances which produce the gas are placed in a generator which is arranged either in the interior of the syringe itself, or directly connected to that syringe, so that the gas is generated either directly in the syringe by means of which it is applied, or in a generator which is directly connected to that syringe. The novel arrange-

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ment makes it quite certain that the gas applied by the syringe is actually the gas which is needed for the treatment, and that the proper concentration of the gas and the correct pressure conditions of the latter are definitely assured, as the admission of additional air is reliably prevented. The control thus established will be more certain still if in each particular case only the exact quantity of gas generating substances needed for the gas generation of that particular case are placed in the generator.

Additional features and advantages of the invention will be understood from the following detailed description, taken in connection with the accompanying drawings, forming a part of this application, and in which I have illustrated by way of example two preferred embodiments of the invention. However, it is to be understood that the invention is not confined to any strict conformity with the showing of the drawings, but may be changed or modified, so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appending claims.

In the drawings in which like and corresponding parts are referred to by the same reference numerals in all of the several figures:

Fig. 1 is a longitudinal sectional view of a gas-syringe having the gas-generator arranged in the interior of the syringe;

Fig. 2 is a longitudinal sectional detail view of the gas-generator and piston of Fig. 1 with portions of the piston broken away, showing the gas generating substances contained in the gas-generator;

Fig. 2a is a longitudinal sectional detail view of the stopper for the gas-generator of Fig. 2;

Fig. 3 is a longitudinal sectional view of the syringe of Fig. 1, showing the syringe closely before the end of the gas generation and the cannula pushed onto the pointed end of the syringe;

Fig. 4 is a fragmentary sectional view of a modified construction, showing a separate gas-generator detachably connected to the pointed end of the syringe.

Referring now to the drawings in detail, the reference numeral 1 denotes the hollow tubular casing of the syringe consisting either of fire-proof tempered glass or of any other suitable material. The cylindrical casing 1 is provided at its front end with a pointed end portion of standard size and formation. Positioned in the interior of the tubular casing 1 is a piston means including a piston 2 and a hollow compartment or member 3, and consisting of the same ma-

terial as the cylinder 1. The piston 2 is provided on its outside with a ground surface slidably and air-tightly fitted into the cylinder 1. In order to insure a perfect sealing and to reduce the friction to a minimum the slide surfaces may be coated with suitable greasing material. The hollow member 3 constitutes a gas-generator and corresponds in form essentially to that of the piston 2. A detachable stopper 5 is fitted into an opening in the forward end of the gas-generator. The stopper 5 has an inwardly projecting end portion of tube-like formation which is provided with an internal passage 4 and which extends into the hollow member 3 to about the center of the latter. Owing to this construction the gases produced in the generator 3 will freely pass through the passage 4 into the interior of the tubular casing 1 as soon as an overpressure in the generator has been created, while on the other hand liquid and solid substances will not be able to reach the inner opening of the passage 4, because of their static tendency of gravitating toward the lowest point and because of the fact that normally less than half of the generator will be filled with the liquid and solid gas generating substances, so that the latter will not reach up to the inner opening of the passage 4 positioned in the center of the generator. In addition to this construction of the generator has the advantage of affording free access to the interior of the hollow member 3 for cleaning and refilling after the stopper has been removed, while, with the stopper inserted into the generator, dropping out of the liquid and solid substances is reliably prevented, so that these substances can not pass through the aperture in the hollow pointed end of the tubular casing 1 with the spot to be treated. In order to charge the gas-syringe with the gas generating material the closing cap 8 is removed, whereupon the piston 2 and the generator 3 attached to the latter are withdrawn from the cylinder 1. Then the stopper 5 is pulled out (see Fig. 2) and a predetermined quantity of a suitable gas generating substance 6, for instance chloride of lime, introduced into the generator 3. After this a suitable liquid 7, such as muriatic acid, formic acid or tartaric acid, is added and the stopper 5 pushed back into the neck portion of the generator, whereupon the piston 2 and member 3 are reinserted into the cylinder 1. The gases generated in the generator will first drive the air out of the syringe. But as soon as the gas begins to escape from the syringe the closing cap 8 is firmly pushed onto the pointed end of the latter. When the gas pressure in the interior of the tubular casing 1 increases, the piston 2 is forced backward, and as soon as the generating process has come to an end the volume of the quantity of gas accumulated in the cylinder chamber 12 can be read on the scale 9. The closing cap 8 is removed now, whereupon the pointed end of the syringe can be pushed into a cannula 11 or into a flexible tube or the like. It is left to the physician to decide at what pressure he wants to apply the gas to the spot to be treated, whereby the quantity of gas pressed out of the syringe can constantly be controlled by means of the scale.

For producing the gas also the dry way of gas generation may be employed. In the latter case a suitable solid substance, such as paraformaldehyde, is introduced into the inner compartment of generator 3, the quantity of the substance placed in the generator varying in each particular case according to requirements. After

reinsertion of the piston and generator into the cylinder the syringe is heated, and as soon as the air has been driven out, the closing cap is pushed onto the pointed end until the gas generation has been completed.

In the modification illustrated in Fig. 4 the gas is generated in a special container 3' connected to the pointed end of the syringe by a sleeve 12. Here, too, the quantity of gas generating substances 6 and 7 employed depends upon what is needed for the particular case in question. The gases entering the interior of the casing 1 displace the piston 2 in backward direction. When the generating process has been completed the closing cap 8 is pushed onto the pointed end of the syringe, or the pointed end is directly inserted into a cannula 11.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A syringe for injecting gas, comprising, in combination, a hollow tubular casing having a pointed end formed with an aperture; a piston slidably arranged within said tubular casing and air tightly fitting therein; and a hollow member arranged in the interior of said tubular casing between said piston and said pointed end of said casing, said hollow member being formed within an opening at the front end thereof facing said end of said tubular casing and permitting communication between the interior of said hollow member and the interior of said tubular casing, the interior of said hollow member being adapted to receive gas generating substances so that gas generated in said hollow member passes through said opening therein into the interior of said tubular casing for being expelled by said piston through said aperture in said pointed end of said tubular casing.

2. A syringe for injecting gas, comprising, in combination, a hollow tubular casing having a pointed end formed with an aperture; a piston slidably arranged within said tubular casing and air tightly fitting therein; and a hollow piston-shaped member slidably arranged in the interior of said tubular casing between said piston and said pointed end of said casing, said hollow piston-shaped member being formed with an opening at the front end thereof facing said end of said tubular casing and permitting communication between the interior of said hollow piston-shaped member and the portion of the interior of said tubular casing located between said hollow piston-shaped member and said pointed end of said tubular casing, the interior of said hollow piston-shaped member being adapted to receive gas generating substances so that gas generated in said hollow piston-shaped member passing through said opening therein into said portion of the interior of said tubular casing pushes said piston-shaped member and thereby said piston away from said pointed end, said piston and said piston-shaped member being manually movable towards said pointed end for expelling gas from said portion of the interior of said tubular casing through said aperture.

3. A syringe for injecting gas, comprising, in combination, a hollow tubular casing having a pointed end formed with an aperture; a piston slidably arranged within said tubular casing and air tightly fitting therein; a hollow member arranged in the interior of said tubular casing between said piston and said pointed end of said casing, said hollow member being formed with an opening at the front end thereof facing said end of said tubular member, the interior of said

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hollow member being adapted to receive gas generating substances through said opening; and a stopper detachably fitting into said opening of said hollow member and having a projection extending into the interior of said hollow member substantially to the center of the same, said stopper and said projection being formed with a longitudinal passage extending through the entire length of said stopper and permitting communication between the interior of said hollow member and the interior of said tubular casing and permitting gas generated in the interior of said hollow member to pass into the interior of said tubular casing for being expelled through said aperture in said pointed end of said tubular casing.

4. A syringe for injecting gas, comprising, in combination, a hollow tubular casing having a pointed end formed with an aperture; a piston slidably arranged within said tubular casing and air tightly fitting therein; a hollow piston-shaped member arranged in the interior of said tubular casing between said piston and said pointed end of said casing, said hollow piston-shaped member being formed with an opening located opposite said pointed end of said tubular casing, the interior of said hollow piston-shaped member being adapted to receive a gas generating substance through said opening; and a stopper detachably fitting into said opening of said hollow member and being formed with a longitudinal passage extending through the entire length of said stopper and permitting communication between the interior of said hollow piston-shaped member and the interior of said tubular casing and permitting gas generated in the interior of said hollow member to pass into the interior of said tubular casing for being expelled through said aperture in said pointed end of said tubular casing.

5. A syringe for injecting gas as claimed in claim 3 and including a detachable closing cap seated on said pointed end of said tubular casing for retaining gas generated by said gas generating substances in said tubular casing.

6. A syringe for injecting gas, comprising, in combination, a hollow tubular casing having a pointed end formed with an aperture, said tubular casing being provided with a graduated scale; a piston slidably arranged within said tubular casing and air tightly fitting therein; a hollow piston-shaped member arranged in the interior of said tubular casing between said piston and said pointed end of said casing, said hollow member being formed with an opening facing said pointed end of said tubular casing, the interior of said hollow piston-shaped member being adapted to receive gas generating substances through said opening; and a stopper detachably

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fitting into said opening of said hollow member and being formed with a longitudinal passage extending through the entire length of said stopper and permitting communication between the interior of said hollow piston-shaped member and the interior of said tubular casing and permitting gas generated in the interior of said hollow member to pass into the portion of the interior of said tubular casing located between said hollow piston-shaped member and said pointed end of said tubular casing and to move said piston-shaped member and thereby said piston away from said pointed end, the position of said piston-shaped member with respect to said graduated scale indicating the amount of generated gas.

7. A syringe for injecting gas as claimed in claim 1 wherein said tubular casing is provided with a graduated scale indicating the position of said piston, and including a detachable closing cap seated on said pointed end of said tubular casing during gas generation so that the generated gas pushes back said piston to a retracted position indicated by said graduated scale.

8. A syringe for injecting gas, comprising, in combination, a hollow tubular casing having an end portion formed with an aperture; piston means slidably arranged in said tubular casing and air-tightly fitting therein and having a compartment adapted to receive gas generating substances, said piston means being formed with at least one opening on the front end thereof facing said end portion of said tubular casing so that said compartment communicates through said opening with the interior of said hollow tubular casing; and a closing cap detachably seated on said end portion of said tubular casing so that gas generated in said hollow piston-shaped member passing through said opening into the interior of said tubular casing pushes back said piston-shaped member into a retracted position from which it may be manually advanced for expelling gas through said aperture.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
788,577	Blackman	May 2, 1905
1,090,833	Braumberger	Mar. 24, 1914
1,099,848	Dunlop	June 9, 1914
1,279,069	Yoshida	Sept. 17, 1918
2,032,559	Barton	Mar. 3, 1936

FOREIGN PATENTS

Number	Country	Date
279,837	Great Britain	June 7, 1928
603,353	France	Jan. 8, 1926
816,248	France	Apr. 26, 1937