CLAIMS

1. A syringe for injecting an injection objective substance into an injection target area of a living body without using any injection needle, the syringe comprising:

an enclosing unit which encloses the injection objective substance;

an ignition unit which includes an ignition charge capable of generating a plasma having a high temperature and a high pressure during combustion immediately after the ignition, and suddenly lowering the high pressure generated such that no gas component is contained when an ordinary temperature is provided and a combustion product is condensed;

a combustion chamber into which the condensed combustion product is allowed to flow and which accommodates a gas generating agent that is to be combusted by the combustion product to produce a predetermined gas;

a pressurizing unit which pressurizes the injection objective substance enclosed in the enclosing unit; and

a flow passage unit which defines a flow passage so that the injection objective substance, which is pressurized by the pressurizing unit, is allowed to inject to the injection target area, wherein the pressurizing unit has:

a first pressurizing mode in which a pressure applied to the injection objective substance in the pressurizing unit is raised to a first peak pressure in order to allow the injection objective substance to penetrate through a surface of the injection target area, and then the pressure applied to the injection objective substance is lowered to a waiting pressure; and

a second pressurizing mode in which the injection objective substance having the waiting pressure is pressurized so that the pressure applied to the injection objective substance is raised to a second peak pressure to inject a predetermined injection amount of the injection objective substance,

characterized in that the pressurizing unit uses an increase in pressure generated by the combustion of the ignition charge in the ignition unit as a pressurization transition until arrival at the first peak pressure in the first pressurizing mode, and an increase in pressure brought about by the predetermined gas produced by the gas generating agent as a pressurization transition until arrival at the second peak pressure in the second pressurizing mode.

2. The syringe according to claim 1, wherein the waiting pressure is not more than ~~a first predetermined ratio with respect to~~50% of the first peak pressure.

3. The syringe according to claim 1 or 2, wherein:

the second peak pressure is not more than the first peak pressure; and

a pressure difference between the first peak pressure and the second peak pressure is within a second predetermined ratio with respect to the first peak pressure.

4. The syringe according to claim 1 or 2, wherein the second peak pressure is a pressure which exceeds the first peak pressure.

5. The syringe according to any one of claims 1 to 4, wherein a rate of pressure increase, which is provided from the waiting pressure to arrival at the second peak pressure in the second pressurizing mode, is lower than a rate of pressure increase which is provided from start of pressurization to arrival at the first peak pressure in the first pressurizing mode.

6. The syringe according to any one of claims 1 to 5, wherein an amount of the injection objective substance

in the second pressurizing mode is larger than an amount of the injection objective substance in the first pressurizing mode.

~~7. The syringe according to any one of claims 1 to 6, further comprising:~~

~~an ignition device which includes an ignition charge; and~~

~~a combustion chamber into which a combustion product produced by combustion of the ignition charge is allowed to flow and which accommodates a gas generating agent that is to be combusted by the combustion product to produce a predetermined gas, wherein:~~

~~the syringe is constructed so that a pressure in the combustion chamber is applied to the injection objective substance enclosed in the enclosing unit, and wherein the pressurizing unit uses:~~

~~an increase in pressure generated by the combustion of the ignition charge in the ignition device as a pressurization transition until arrival at the first peak pressure in the first pressurizing mode; and~~

~~an increase in pressure brought about by the predetermined gas produced by the gas generating agent as a pressurization transition until arrival at the second peak pressure in the second pressurizing mode.~~

~~8. The syringe according to claim 7, wherein a~~

~~decrease in pressure, which is brought about by condensation of the combustion product in the combustion chamber in the first pressurizing mode, is used as a depressurization transition from the first peak pressure to the waiting pressure.~~

~~9~~7. The syringe according to ~~claim 7 or 8~~any one of claims 1 to 6, wherein:

a combustion completion time of the ignition charge comes earlier than a combustion completion time of the gas generating agent; and

a velocity of production of the gas from the gas generating agent is increased at a stage at which the combustion of the ignition charge is completed and the pressure applied to the injection objective substance is decreased from the first peak pressure to the waiting pressure.

~~10~~8. The syringe according to any one of claims ~~7 to 9~~1 to 7, wherein the ignition charge is any one of explosive charges of an explosive charge containing zirconium and potassium perchlorate, an explosive charge containing titanium hydride and potassium perchlorate, an explosive charge containing titanium and potassium perchlorate, an explosive charge containing aluminum and potassium perchlorate, an explosive charge containing aluminum and bismuth oxide, an explosive charge containing aluminum and molybdenum oxide, an explosive charge containing aluminum

and copper oxide, and an explosive charge containing aluminum and iron oxide, or an explosive charge composed of a combination of a plurality of the foregoing explosive charges.

~~11. A method of operating a syringe for injecting an injection objective substance into an injection target area of a living body without using any injection needle, the method including:~~

~~providing, within the syringe, an enclosing unit which encloses the injection objective substance;~~

~~providing, within the syringe, a pressurizing unit which pressurizes the injection objective substance enclosed in the enclosing unit; and~~

~~providing, within a syringe, a flow passage unit which defines a flow passage so that the injection objective substance, which is pressurized by the pressurizing unit, is allowed to inject to the injection target area,~~

~~pressurizing by the pressurizing unit in a first pressurizing mode in which a pressure applied to the injection objective substance in the pressurizing unit is raised to a first peak pressure in order to allow the injection objective substance to penetrate through a surface of the injection target area, and then the pressure applied to the injection objective substance is lowered to a waiting pressure; and~~

~~pressurizing by the pressurizing unit in a second~~

~~pressurizing mode in which the injection objective substance having the waiting pressure is pressurized so that the pressure applied to the injection objective substance is raised to a second peak pressure to inject a predetermined injection amount of the injection objective substance.~~

~~12. A method of injecting an injection objective substance from a syringe into an injection target area of a living body without using any injection needle, the method including:~~

~~providing, within the syringe, an enclosing unit which encloses the injection objective substance;~~

~~providing, within the syringe, a pressurizing unit which pressurizes the injection objective substance enclosed in the enclosing unit; and~~

~~providing, within a syringe, a flow passage unit which defines a flow passage so that the injection objective substance, which is pressurized by the pressurizing unit, is allowed to inject to the injection target area,~~

~~pressurizing by the pressurizing unit in a first pressurizing mode in which a pressure applied to the injection objective substance in the pressurizing unit is raised to a first peak pressure in order to allow the injection objective substance to penetrate through a surface of the injection target area, and then the pressure applied to the injection objective substance is lowered to~~

~~a waiting pressure; and~~

~~pressurizing by the pressurizing unit in a second pressurizing mode in which the injection objective substance having the waiting pressure is pressurized so that the pressure applied to the injection objective substance is raised to a second peak pressure to inject a predetermined injection amount of the injection objective substance.~~

~~13~~9. A syringe ~~method of~~having an adjustable~~ing an~~ injection depth in an injection target area of a living body with a syringe for injecting an injection objective substance without using any injection needle, the ~~method~~syringe comprising~~including~~:

~~providing, within the syringe, an~~ enclosing unit which encloses the injection objective substance;

an ignition unit which includes an ignition charge capable of generating a plasma having a high temperature and a high pressure during combustion immediately after the ignition, and suddenly lowering the high pressure generated such that no gas component is contained when an ordinary temperature is provided and a combustion product is condensed;

a combustion chamber into which the condensed combustion product is allowed to flow and which accommodates a gas generating agent that is to be combusted by the combustion product to produce a predetermined gas;

~~providing, within the syringe, a~~ pressurizing unit which pressurizes the injection objective substance enclosed in the enclosing unit; and

~~providing, within a syringe,~~ a flow passage unit which defines a flow passage so that the injection objective substance, which is pressurized by the pressurizing unit, is allowed to inject to the injection target area, wherein the pressurizing unit has:

~~pressurizing by the pressurizing unit in~~ a first pressurizing mode in which a pressure applied to the injection objective substance in the pressurizing unit is raised to a first peak pressure in order to allow the injection objective substance to penetrate through a

surface of the injection target area, and then the pressure applied to the injection objective substance is lowered to a waiting pressure; and

~~pressurizing by the pressurizing unit in~~ a second pressurizing mode in which the injection objective substance having the waiting pressure is pressurized so that the pressure applied to the injection objective substance is raised to a second peak pressure to inject a predetermined injection amount of the injection objective substance,

characterized in that the pressurizing unit uses an increase in pressure generated by the combustion of the ignition charge in the ignition unit as a pressurization transition until arrival at the first peak pressure in the first pressurizing mode, and an increase in pressure brought about by the predetermined gas produced by the gas generating agent as a pressurization transition until arrival at the second peak pressure in the second pressurizing mode.