

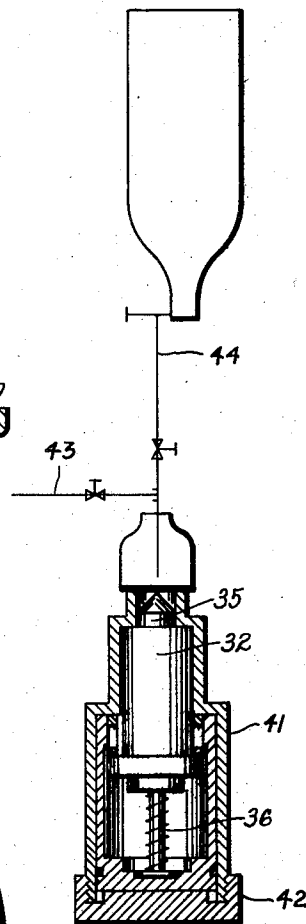
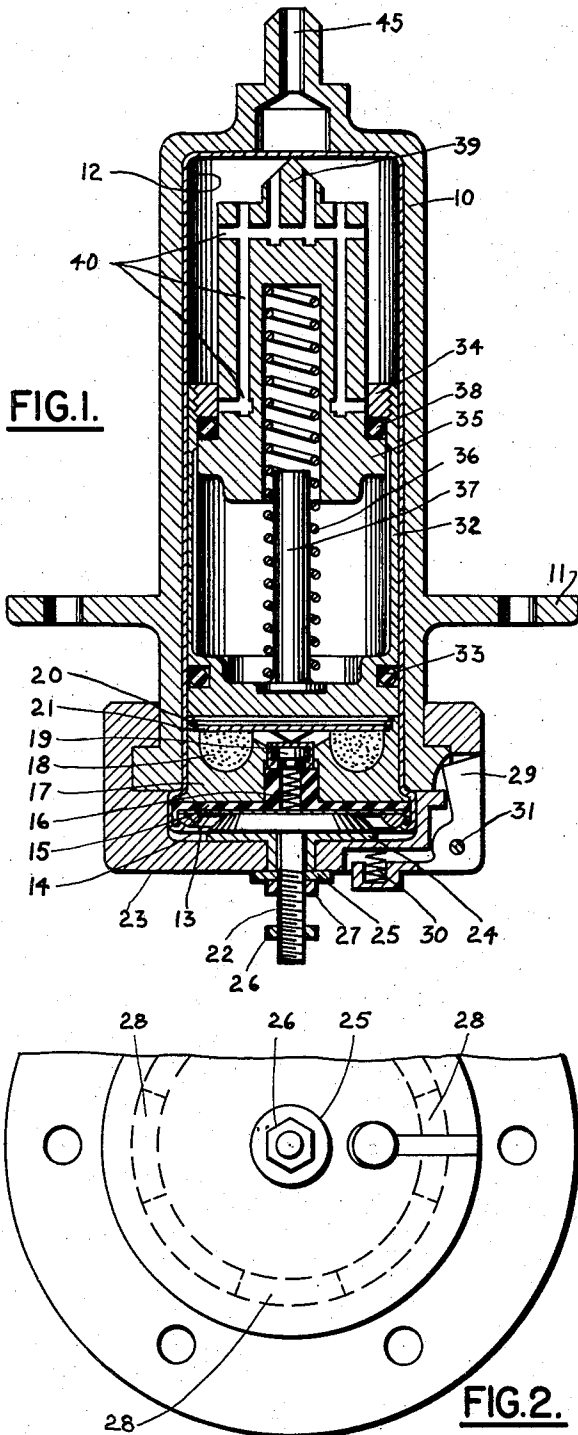
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NON-CORROSIVE GAS GENERATOR

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NON-CORROSIVE GAS GENERATOR

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1 Claim. (Cl. 23—281)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to gas generators such as are adapted to energize the actuating element of various types of devices, and has for its principal object the provision of an improved gas generator which functions to deliver a non-corrosive control gas.

Various types of actuators utilizing gun powder as the energizing element are well known to those skilled in the art. Such actuators have the disadvantage that a corrosive gas gets into the working parts of the mechanism. As a result, they are useful only in the case of one-shot devices or where the device can be carefully cleaned after each shot.

In accordance with the present invention, this difficulty is avoided by the provision of an actuator which functions to deliver a non-corrosive control gas such as carbon dioxide or the like.

Liquid CO₂ boils away slowly at normal temperatures. As it boils away, it tends to become cooler, and, in large quantities, finally reaches a temperature at which it will no longer boil. To prevent this, there is provided an arrangement which puts the energy of an explosive charge into the liquid CO₂, thus raising its temperature to a point where it boils away almost explosively.

The invention will be better understood from the following description considered in connection with the accompanying drawings and its scope is indicated by the appended claim.

Referring to the drawings:

FIG. 1 illustrates a preferred embodiment of the invention,

FIG. 2 is an end view of the device of FIG. 1, and

FIG. 3 is an explanatory drawing relating to the insertion of the liquid CO₂ into the device of FIG. 1.

The actuator of FIG. 1 includes an enclosure 10 having a supporting bracket 11. Mounted within the enclosure 10 is a casing 12 which is closed at its bottom end by an explosive cartridge and may be provided with an electrically conductive protective coating.

This cartridge includes a seal 13, a silver plated closure disk 14, an insulation disk 15, a silver plated contact spring 16, a head 17, an explosive charge 18, an electric primer 19, a powder retainer disk 20 and a disk retainer ring 21. Operating voltage is applied to the electric primer 19 through a member 22 which is electrically insulated from an end cap 23 by insulators 24 and 25 and has threaded upon it a pair of nuts 26 and 27 between which the input lead is clamped. The return circuit is through the grounded parts in contact with primer 19.

The cap 23 is held in place by interrupted lugs 28 which cooperate with similar lugs on the end of enclosure 10. When these two sets of lugs are in cooperative relation they are locked together, by a member 29 which is pivoted at 31 and is biased to its illustrated position by a spring 30.

Mounted within the casing 12 is a cylindrical container 32 having at one of its ends adjacent and in heat transfer relation to a fired explosive charge 18, an external seal 33 in a cylinder end wall in the form of an O-ring, and at the other of its ends a seal ring 34. The cylinder 32 is arranged to cooperate with a piston 35 through the medium of a spring 36, a spring guide 37 and an unsup-

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ported area seal 38. This seal may constitute an abutment to limit movement of piston 35 away from the lower end wall of cylinder 32.

The piston 35 is biased to its illustrated position by the spring 36, has at its upper edge a sharp edged projection 39 or punch for casing 12 and an elongated extension on the upper side of said piston is provided with an intricate network of small tortuous passageways 40 some at 90° to others as illustrated.

In the illustrated position of the piston 35, the cylinder 32 is sealed against the escape of any liquid it may contain. However, if the piston is moved past the point where the inner bore of the cylinder is fluted, there is provided an opening between the cylinder and the passageways 40.

How liquid CO₂ is introduced into the cylinder 32 will now be explained by reference to FIG. 3. As indicated in this figure, the cylinder 32 and piston 35 are placed within a housing 41, and an end cap 42 is screwed onto the housing, thus compressing the spring 36 so that the seal between the cylinder 32 and the passageways 40 is broken.

Under these conditions, the entire container is evacuated through a pipe 43 which leads to a vacuum pump. The liquid CO₂ is then admitted to the container through a pipe 44. Removal of the end cap 42 will now permit the pressure container to move apart and restore the seal between the cylinder 32 and the passageways 40. The cylinder and piston assembly are then mounted in the casing 12 as described in connection with FIG. 1.

Operation of the actuator of FIG. 1 is initiated by completing an electric circuit between the electrically insulated member 22 and a grounded part of the device. This fires the electric primer 19 which ignites the charge 18 and drives the cylinder 32 and the piston 35 upwardly so that the casing 12 is pierced by the projection 39.

Further expansion of the explosive gases tends to move the cylinder 32 against the spring and gas pressure so as to open the seal between the cylinder and the passageways 40. The CO₂ liquid is then forced into the intricate network of small tortuous passageways 40 and finally out through the discharge tube 45.

It will be understood that all the energy of the explosive cartridge tends to create turbulence in the liquid as it is flowing through the small orifices. These orifices have been made with sharp corners to add to the energy exchange. Also the heat from the explosion of the powder heats the cylinder and piston. This transfer of energy converts liquid CO₂ or other gases with similar characteristics, into gas very rapidly. Since this gas is non-corrosive, cleaning of the actuating element of the operated device is avoided and the actuator may be used repeatedly without cleaning.

I claim:

A non-corrosive gas generator having a cylindrical container for liquid to be vaporized, said container having an end wall through which heat is adapted to be transferred to such a liquid, means outside said container for retaining an explosive adjacent said end wall and by which said explosive may be fired, a casing surrounding said container and said means whereby said container may be guided away from said means, a piston slidable in said container, an abutment in said container for limiting outward movement of said piston away from said end wall, a spring cooperating with said end wall and piston and tending to separate them, an extension on said piston on a side away from said end wall and provided with passageways having sharp bends therein for creating turbulence in a liquid being ejected from said container and vaporized, said passageways being open at an outer end portion of said extension and also adjacent said piston on a side of said extension, an outer extremity of said

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extension being provided with a punch type cutter for opening an outer end of said casing, and around said cutter said container being shaped to engage and be stopped by the casing outer end surrounding a punched out portion as the container may be moved outward by said explosive fired in the casing, said container having an inner surface of its side walls longitudinally fluted from said container end wall adjacent an explosive to adjacent said container abutment to allow the ingress and egress of liquid passing said piston, when said piston is spaced inward from said abutment with said spring com-

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pressed as said container is moved outwardly by expanding products of combustion of said explosive.

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