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GAS GENERATOR

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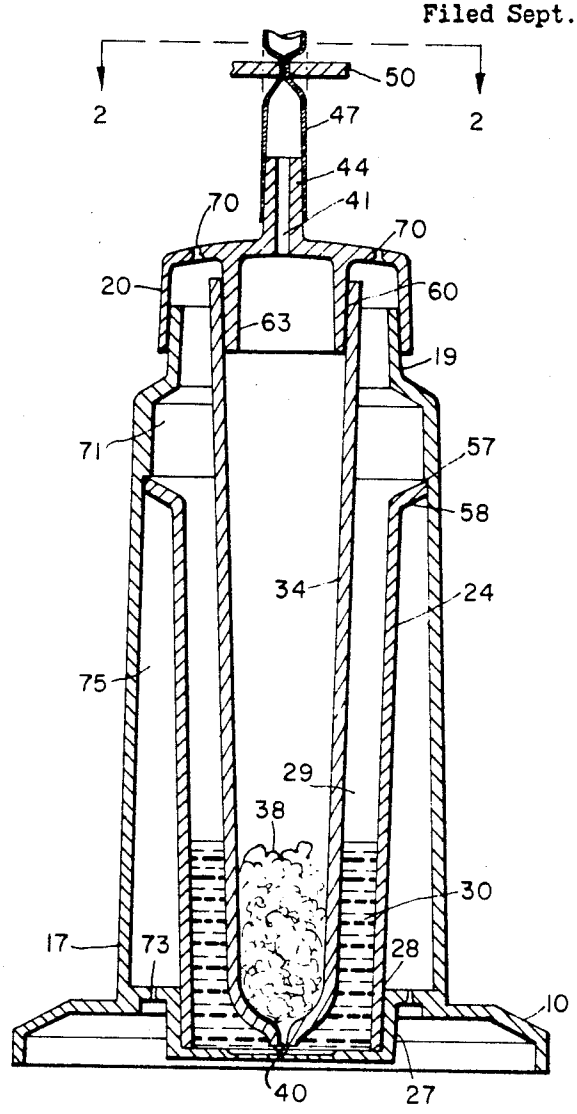


FIG. 1

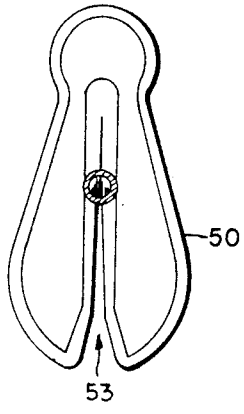


FIG. 2

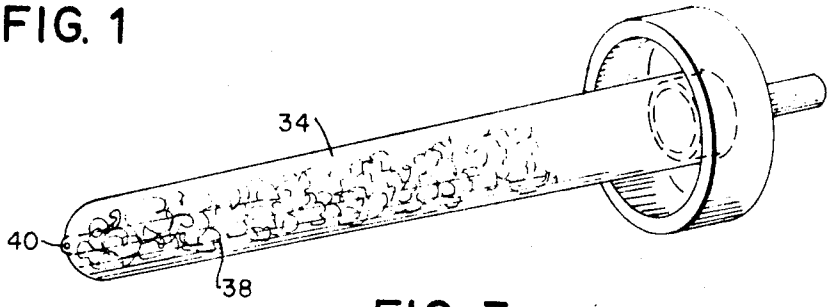


FIG. 3

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GAS GENERATOR

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ABSTRACT OF THE DISCLOSURE

A simple and economical apparatus particularly for science class demonstration of the generation of gases by reaction of chemicals, viz., a solid and a liquid. For example, zinc and hydrochloric acid to generate hydrogen. A particular feature of the inventiond resides in the use of readily mass-produced plastic elements of a simple geometric form, such as tubes, etc., preferably transparent, involving basically a concentricity of members wherein such members hold respective entities for effecting the function of generating a gas. Another feature involves provision of a disposable cartridge furnished with a filling of material to react with a liquid.

Briefly, the invention comprises injection molded members wherein, for purposes of demonstrating gas generation, the apparatus comprises a base which supports a tubular housing in vertical position. Concentrically supported within such housing are concentric tubular members for holding a solid to react with an acid wherein the acid has access to the solid. Generated gas is thus permitted to escape through a flexible tube extending from a cap which encloses the upper end of the housing. A pinch clamp on the tube can prevent flow until a desired pressure is realized.

A detailed description of the invention now follows in conjunction with the appended drawing in which:

FIG. 1 is an elevation in cross-section of the gas generator;

FIG. 2 is a plan view showing a pinch member for shutting off flow of generated gas; and

FIG. 3 is a modification of a portion of the construction wherein a disposable cartridge having a solid reactant material therein is illustrated in perspective.

Referring to FIG. 1, the invention comprises a cylindrical plastic base **10** integrally molded with a concentric housing **17** extending vertically upright therefrom and having a neck **19** closed at the top by a cap **20**. Within the housing is a concentric insert sleeve **24** having a sealing fit at interface **27** with a well or cavity **28** of the base, and being spaced from the housing. Sleeve **24** forms a cup or chamber **29** for holding a quantity of reactive liquid **30** around an inwardly spaced concentric tube **34** which holds a quantity of solid material **38**. The liquid has access to the solid through a small or pinhole bore **40** at the bottom of tube **34**.

The reaction forms a gas that rises upwardly and issues through the bore of the integral cap nipple **44** to be trapped by means of a flexible length of hose **47** squeezed shut by a pinch clamp **50** having a slot **53**, all in a manner obvious in FIGS. 1 and 2.

The several members **17**, **24**, **34** have a slight taper to firmly grip and seal with each other in a well known manner.

The device is well sealed as to its co-acting parts and also vented for purposes of safety. Thus, the housing member **17** has a shoulder at **57** sealingly abutting a radial flange **58** of sleeve **24** and cemented thereto. The upper end of tube **34** has a tight sealing fit at **60** with a downwardly extending skirt **63** of cap **20**.

A pair of safety vent ports **70** are provided in the cap so that in the event of dangerous buildup of gas back

pressure, tube **47** being pinched closed, such gas can escape downwardly through port **40** and then up through the liquid **30** and out of the housing through vents **70**, via chamber **71**.

Air expansion vents **73** are also provided in the base to permit air escape from the space **75** between housing **17** and sleeve **24** when air is heated due to the chemical reaction occurring in the apparatus. Thus, double wall protection against gas pressure is provided by housing **17** and sleeve **24**.

For gas generation, e.g., hydrogen, the chamber **30** would contain dilute hydrochloric acid and tube **34** would have a quantity of mossy zinc. Other agents can, of course, be used.

It is contemplated that the insert **24** can have molded calibration rings so that proper volumes of water and acid to be mixed can be accurately gauged.

The cap **20** and tube **34** can be permanently cemented together at the interface **60** to effect a disposable cartridge with the solid material **38** provided therein ready to use. Such an integral construction is shown in FIG. 3 and has the advantage that the difficulty of cleaning the tube is eliminated. Since the tube is of plastic the scrubbing required would impair transparency and since the disposable elements are low cost the advantage is apparent. This is particularly so since the apparatus is primarily for class demonstration and certain reactions may produce colored gases, in which cases visibility is important.

While the construction preferably contemplates a double wall safety arrangement wherein base **10** and sleeve **24** are permanently bonded to housing **17** as an integral unit effecting a pair of venting chambers **71** and **75** and effecting a double thick wall around the bottom of acid chamber **30**, it will be understood that separate pieces could be used to be assembled when required.

From the description above it will be apparent that the cap **20** and tube **17** effect an egress means for generated gas, while the tube **34** forms the inner wall of a substantially toroidal liquid holding chamber **30** in conjunction with a chamber outer wall afforded by the sleeve **24**. Accordingly, the unitary structure of the cap and tube are well adapted to effect a disposable cartridge which readily coacts in assembly with the sleeve and housing to form a safe and rugged structure for the purpose intended.

I claim:

1. A gas generating apparatus comprising a housing, a tube therein for holding a solid reactant material and having a port, said tube having egress means for gas generated in said tube, a sleeve in said housing disposed intermediate said housing and said tube; support connection means between said housing and sleeve whereby said sleeve is supported in said housing; said housing and sleeve effecting a double wall enclosure around said tube; wherein said sleeve effects a wall of a chamber for holding a liquid to react with a solid in said tube by access through said port, a base for said housing having a well, said support connection means for said sleeve comprising one end of said sleeve being socketed in said well and having a liquid tight connection therein and said support connection means further comprising a flange at the other end of said sleeve having a gas tight connection with the interior walls of said housing, said port of said tube being disposed substantially within the confines of said well, said chamber for holding a liquid comprising the spacing between said sleeve and tube.

2. An apparatus as set forth in claim **1**, said base, said housing and said sleeve being permanently bonded to form an integral unit.

3. An apparatus as set forth in claim **1**, further comprising closure means for closing one end of said sleeve

and said closure means having a vent passage communicating with said chamber for venting excess gas pressure.

4. An apparatus as set forth in claim 1, further comprising a vent chamber between said sleeve and said housing having a vent port for venting air pressure effected by the heat of chemical reaction in said apparatus.

5. An apparatus as set forth in claim 1, further comprising means for closing one end of said sleeve having a vent passage communicating with said chamber for venting excess gas pressure, the spacing between said sleeve and said housing effecting a vent chamber communicating with the atmosphere external to said housing for venting air pressure effected by the heat of chemical reaction in said apparatus.

6. An apparatus as set forth in claim 1, further comprising means for closing one end of said housing and having a vent communicating with said liquid holding chamber for venting excess gas pressure; the spacing between said sleeve and said housing effecting a vent chamber, and means for venting air pressure from said latter vent chamber to the atmosphere external to said housing wherein said air pressure is effected by the heat of chemical reaction in said apparatus.

7. An apparatus as set forth in claim 1, said egress means comprising a cap having a sealing friction fit with said housing, said tube having an end permanently bonded to said cap to form a unitary structure.

8. An apparatus as set forth in claim 7, said port being at an opposite end of said tube.

9. An apparatus as set forth in claim 8, said cap and tube being of transparent plastic material and effecting a unitary cartridge disposable after said solid material is consumed, and a charge of solid reactant material in said tube.

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