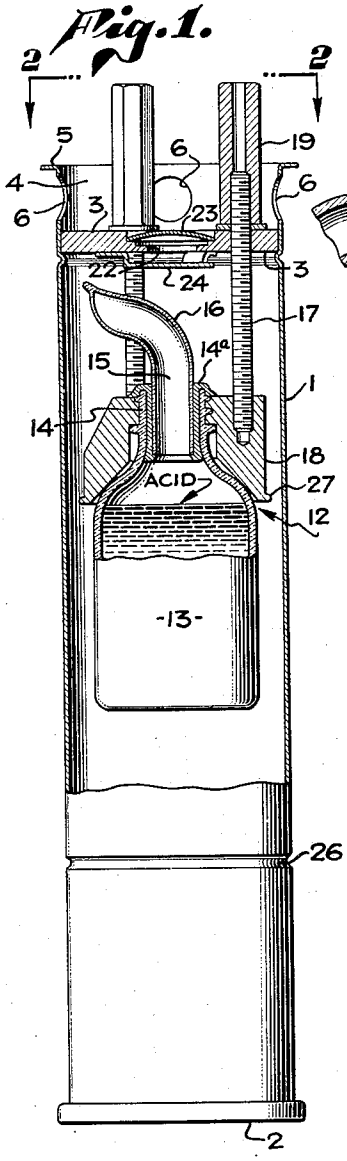
April 10, 1951 P. E. FRANTZ 2,548,358

FIRE EXTINGUISHER UNIT

Filed July 6, 1948 4 Sheets-Sheet 1

Fig. 1.



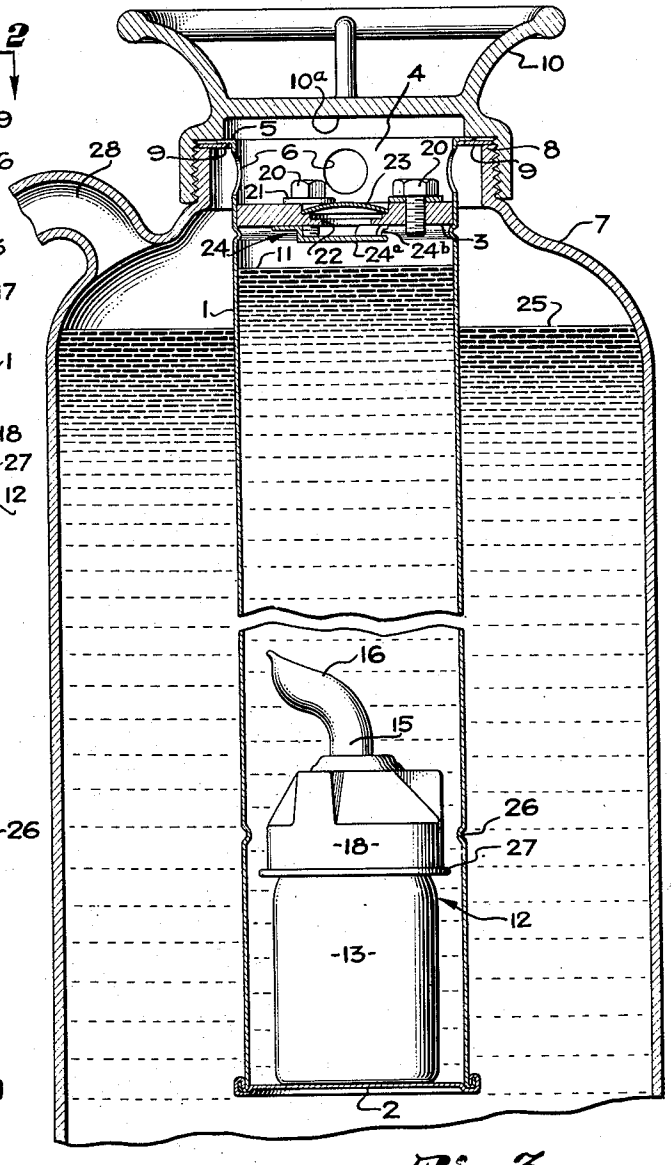


Fig. 3.

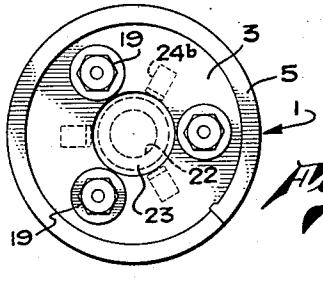


Fig. 2.

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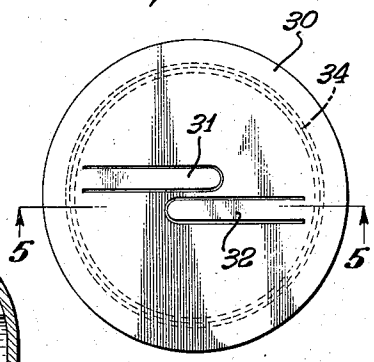
April 10, 1951 P. E. FRANTZ 2,548,358

FIRE EXTINGUISHER UNIT

Filed July 6, 1948 4 Sheets-Sheet 2

Fig. 4.



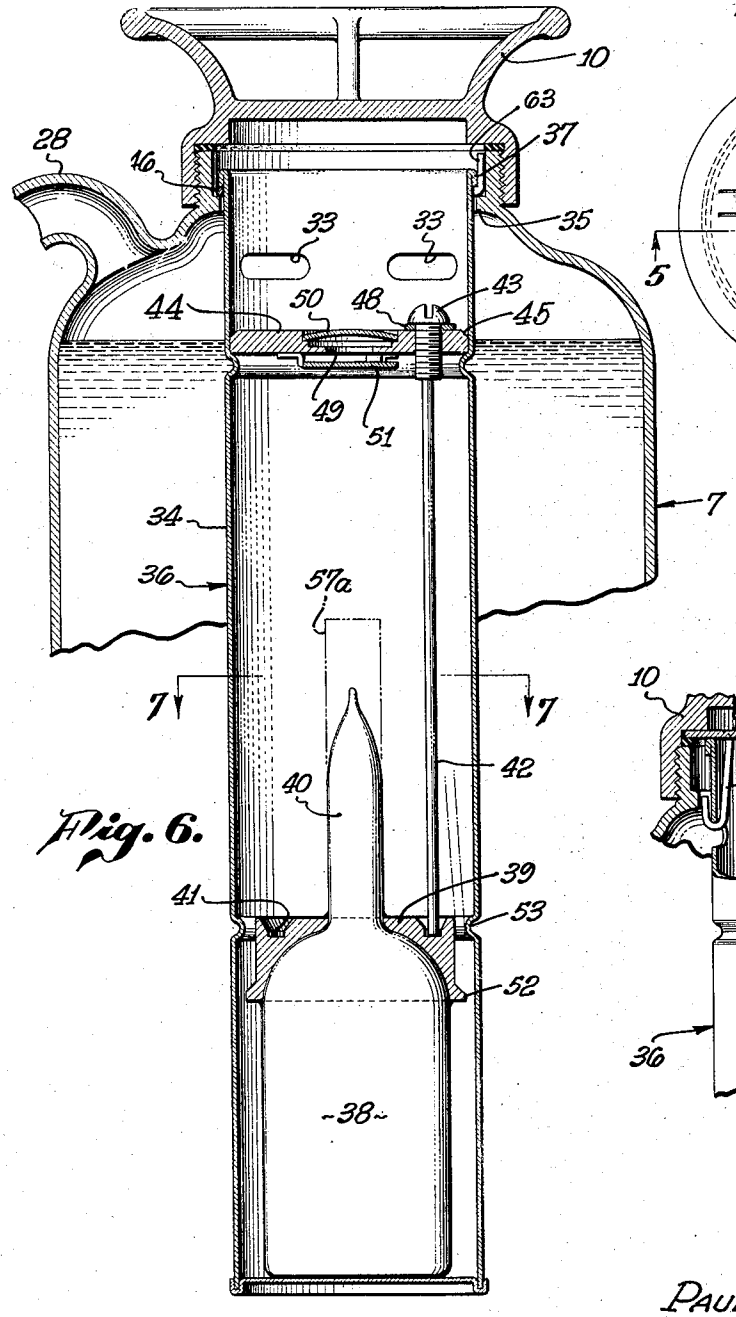
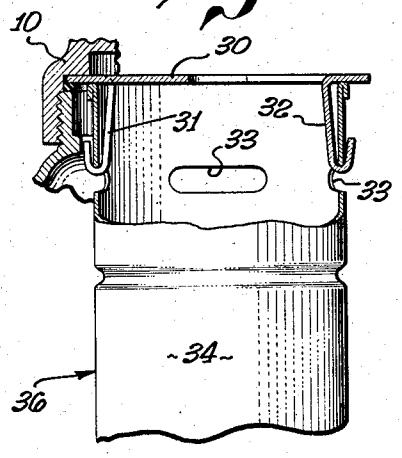


Fig. 6.

Fig. 5.



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FIRE EXTINGUISHER UNIT

Filed July 6, 1948 4 Sheets-Sheet 3

Fig. 7.

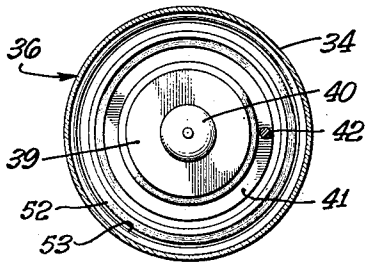


Fig. 8.

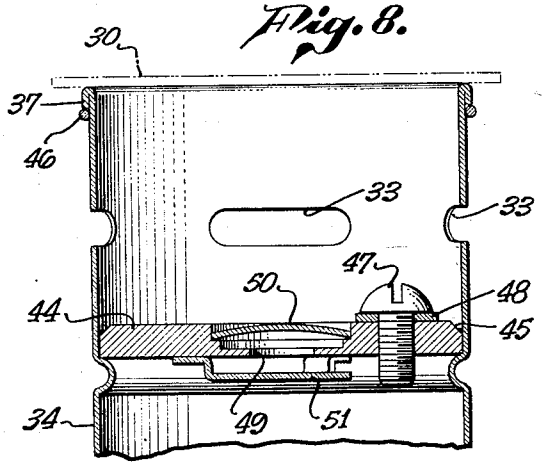


Fig. 9.

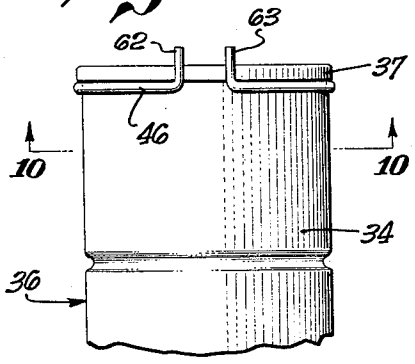


Fig. 10.

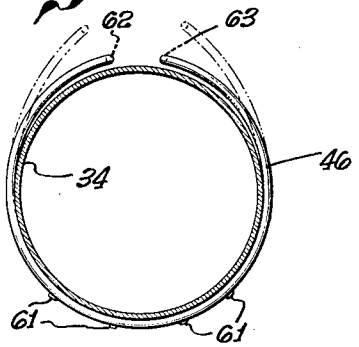


Fig. 11.

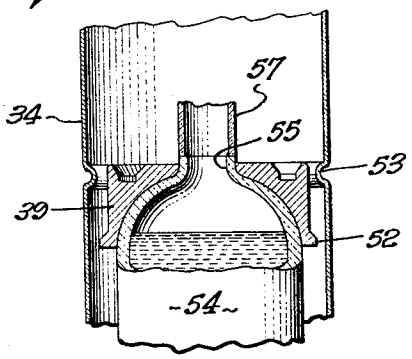
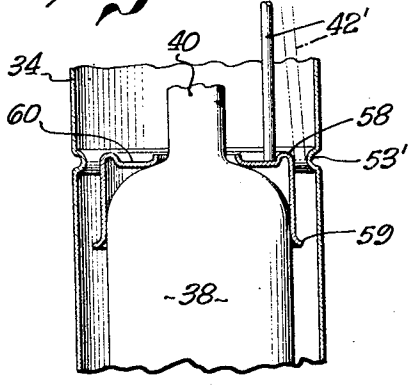


Fig. 12.



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April 10, 1951 P. E. FRANTZ 2,548,358

FIRE EXTINGUISHER UNIT

Filed July 6, 1948 4 Sheets-Sheet 4

Fig. 13.

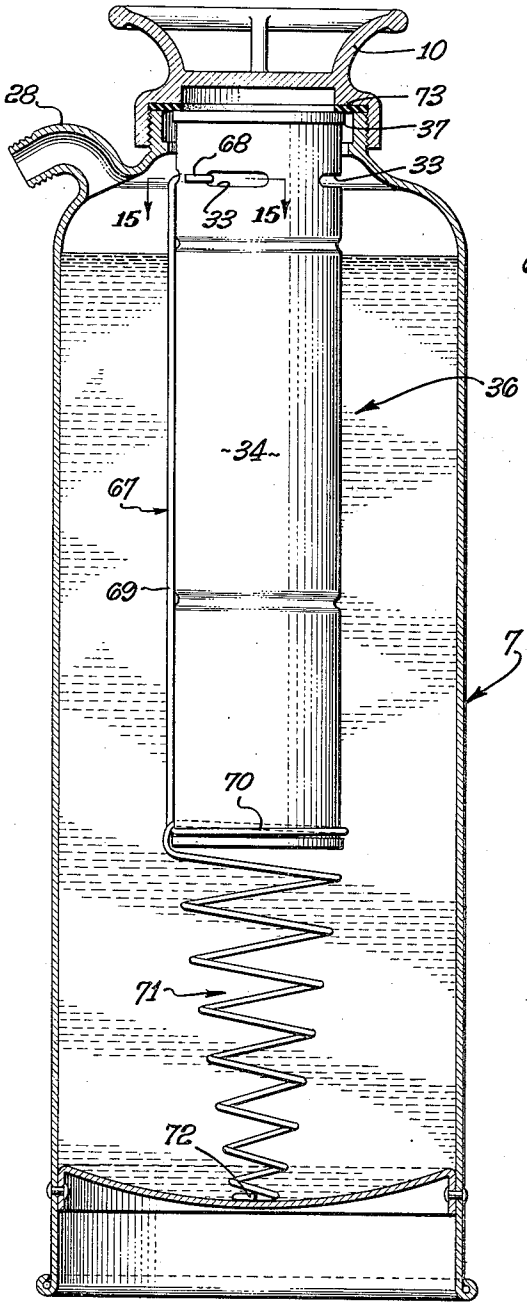


Fig. 14.

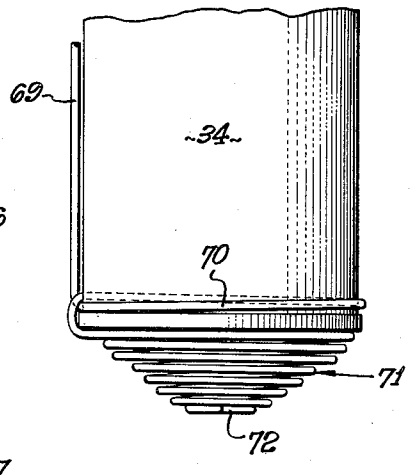
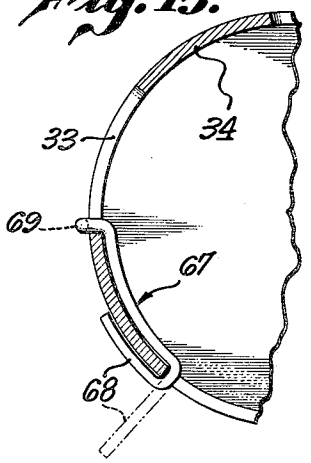


Fig. 15.



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Patented Apr. 10, 1951

2,548,358

UNITED STATES PATENT OFFICE

2,548,358

FIRE EXTINGUISHER UNIT

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Application July 6, 1948, Serial No. 37,146

19 Claims. (Cl. 169—32)

1

This invention relates to fire extinguishers and more particularly to a replaceable activating unit for portable fire extinguishers of the acid-soda or foam generating type.

In this general class of fire extinguishers quantities of acid and a reacting solution are contained in separate but juxtaposed relation adjacent a quantity of extinguisher fluid in a portable tank, the acid and reactant being adapted for intermixing when it is desired to use the extinguisher, thereby forming a large quantity of gas which develops pressure forcibly to eject the extinguisher fluid through a usual nozzle.

The present application comprises a continuation-in-part of my previously filed application, Serial No. 697,274, filed September 11, 1946, now abandoned.

It is old generally to make fire extinguishers of the general type of the present invention. This is true to an extent such that body sizes of the portable reservoirs or tanks in which the extinguishing liquid and gas generating ingredients are contained are fairly well standardized by a number of different manufacturers thereof.

The continued popularity of the present type of extinguisher lies in part in the fact that these extinguishers are effective, comply with the requirements of insurance companies, are large and heavy enough so that they are not easily stolen or removed from their installed position, and their contents are not of general utility, so as to invite theft, or pilfering, and do not deteriorate or evaporate easily. Therefore they usually are available where installed when the need for them arises.

The general market for this type of extinguisher is open, the broader patents thereon having long since expired, so that those competing for the present market must rely on special features, such as special extinguishing fluid, gas generators and the like. However, in spite of any such special features, the basic underlying factors, the sine qua non of this market are cost (including upkeep) and approval by the Board of Fire Underwriters.

An object of the present invention is to make an improved gas generating unit for a portable fire extinguisher.

Another object is to make a gas generating unit for fire extinguishers which will remain in condition of ready availability for use over a period of years without detrimental decomposition, aging or deterioration of active gas generating units contained therein.

2

Another object is to make a gas generating unit for a fire extinguisher having a container for a quantity of acid-reacting fluid, and containing a sealed frangible acid container, the unit being adapted for easy, accurate and safe inspection for condition and availability for use.

Another object is to make a gas generating unit for a fire extinguisher, the unit having a frangible acid container therein, with means for immobilizing and thereby protecting the acid container except when ready for use.

Another object is to make a gas generating unit for a fire extinguisher, the unit having a quantity of acid-reacting fluid therein, and having a frangible acid container of substantially different specific gravity than the acid-reacting fluid immersed therein, the unit being sealed hermetically by a blow-out plug, means being provided to improve and control the gas generating characteristics resulting from the mixing of the acid and the acid-reacting fluid, upon the performance of a simple foolproof operational procedure for the extinguisher.

Another object is to make a gas generating unit for a fire extinguisher wherein a frangible acid container is mounted in an elongated drop chamber containing an acid-reacting fluid of different specific gravity from the acid, the acid container being adapted to drop through the acid-reacting fluid on tilting the chamber to a predetermined position of inversion, and being restrained against dropping prior to reaching such position.

Another object is to make a gas generating unit for a fire extinguisher wherein an acid filled container is mounted normally to rest with its bottom on the lower end of an elongated hermetically sealed drop chamber containing a quantity of acid-reacting fluid of different specific gravity from that of the acid filled container, the acid container having a strong lower end and an easily frangible top portion, the acid container being guided upon inversion of the unit to strike an anvil to fracture and destroy the frangible top portion of the acid container.

Another object is to make an improved acid container for a gas generating unit for a fire extinguisher, the container having a relatively heavy body portion and an easily frangible neck chamber portion containing sufficient acid to insure an active and uniform initial gas generating reaction upon fracture of the frangible neck portion, the opening left by destruction of the neck portion being of proper size to meter the discharge flow of acid from its container.

Another object of the invention is to make a simple and improved gas generating unit for fire extinguishers by providing a simple and effective blow-out plug with a simple and effective arrangement adjacent thereto to control the discharge flow of pressurized gas generating chemicals from the unit for maximum turbulence, intermixing, and gas generating reaction of said chemicals, and to delay dilution of said chemicals by extinguishing liquid for maximum gas generation.

Another object is to make a gas generating unit for a fire extinguisher, the unit being provided with improved top construction for installation and suspension in fire extinguishers.

Another object is to make a gas generating unit for a fire extinguisher wherein an acid container is provided with a shoulder arranged to abut against a removable positioning pin which holds the bottle safely against displacement until the pin is removed to arm the device, the shoulder being adapted, when the pin is removed, to have additional restraining relation with an offset portion of a wall of a chamber in which the acid container is mounted until the chamber is tilted beyond a predetermined angle of inversion.

Another object is to make a gas generating unit for a fire extinguisher, the unit having an acid bottle of heavy rugged construction with a metered neck outlet, a weighted collar being mounted around and substantially flush with the neck opening, a uniform thin walled easily frangible neck portion being secured to the bottle around the neck opening to extend upwardly toward an anvil surface, the neck portion having a capacity for a reaction initiating acid charge, so that the neck portion only will be crushed and destroyed when the device is inverted to cause the weighted bottle to fall toward the anvil.

In order to attain the above objects of the invention, and others which will appear herein, there is provided in accordance with one feature of the invention, a gas generating unit for a fire extinguisher of the type generally known as the inversion operated soda-acid wall type, the gas generating unit having an elongated drop chamber adapted to contain a quantity of acid reacting liquid, and having a novel top structure whereby the chamber can be mounted readily in fire extinguishers having various types of neck openings, the chamber having a top closure member with a blow-out plug mounted in an opening in the closure normally to seal the chamber, a mixing plate being mounted over the opening to promote intimate intermixing and reaction of the contents of the chamber on their discharge therefrom, and before reaching a diluting extinguisher liquid in the body of the extinguisher, so as to produce a maximum amount of gas pressure, the device having a weighted acid container mounted for guided movement longitudinally of the chamber, a safety positioning pin being mounted to abut against a portion of the acid container to hold it against displacement, the pin being removable and replaceable by a sealing pin of a distinguishing color or shape for arming the extinguisher for use, the acid container having a collar adapted to engage a shoulder on the interior of the chamber to resist longitudinal displacement of the acid container until the chamber has been tilted to a predetermined angle of inversion, the acid container being of strong walled construction and having a metered outlet, an easily frangible neck portion, having a desired capacity for an initiating charge of acid

being secured around the acid container outlet and having an easily frangible upper end portion located to strike an anvil area of the chamber upon inversion of the chamber sufficiently to cause the acid container to drop through the acid-reacting fluid in the chamber.

These and other features of the invention will be brought out more fully in the following description and the accompanying drawings, wherein:

Fig. 1 is a side elevational view of one form of gas generating chamber embodying the present invention, portions thereof being broken away on a median vertical plane to disclose the structure thereof, an acid container being shown supported immobilized therein in a safety or "unarmed" condition;

Fig. 2 is a plan view of the gas generating unit of Fig. 1 looking in the direction of the arrows 2—2 of Fig. 1;

Fig. 3 is a vertical transverse sectional view of the gas generating unit of Figs. 1 and 2 as it appears when "armed" with the acid container released for longitudinal movement in the unit chamber, and the unit mounted in a fire extinguisher, the lower end portion of the fire extinguisher being broken away;

Fig. 4 is a plan view of a gas generating unit having a modified form of top suspension plate overlying it, but not yet secured thereto;

Fig. 5 is a fragmentary view partly in elevation and partly in vertical transverse section on line 5—5 of Fig. 4, showing the upper end portion of the gas generating unit of Fig. 4 but with the top mounting disc secured thereto, the unit being shown as it would appear mounted in a fire extinguisher, a fragment of which is shown also;

Fig. 6 is a vertical transverse sectional view showing a further modified gas generating unit as it would appear when suspended in a fire extinguisher, portions of the fire extinguisher being broken away, an acid container being shown in immobilized or unarmed condition, a frangible neck portion of an acid container being indicated in dotted-lines as it would appear before being heat sealed;

Fig. 7 is a sectional view taken in the plane of the line 7—7 of Fig. 6;

Fig. 8 is an enlarged fragmentary vertical transverse sectional view through the upper end portion of the gas generating unit shown in Figs. 6 and 7, the immobilizing pin for the acid container being removed, and a sealing screw of distinguishing color being shown threaded into the opening for the safety positioning pin;

Fig. 9 is a fragmentary side elevation view of the upper portion of a gas generating unit similar to that shown in Figs. 6, 7 and 8;

Fig. 10 is a transverse sectional view taken in the plane of the line 10—10 of Fig. 9;

Fig. 11 is a fragmentary vertical sectional view through a gas generating chamber and the upper portion of the acid container similar to that shown in Fig. 6, the safety positioning pin being removed;

Fig. 12 is a fragmentary sectional view similar to Fig. 11 but showing a modified form of collar mounted around the neck of the acid container, the safety positioning pin being shown in proper securing position in solid lines, and in displaced, but still effective securing position in dot-dash lines;

Fig. 13 is a vertical sectional view through a reservoir of a fire extinguisher showing a modi-

fied spring mounting arrangement for a gas generating unit therein;

Fig. 14 is a fragmentary side elevational view of the lower end portion of the gas generating unit shown in Fig. 13, a supporting spring therefor being shown in fully flattened position for shipping; and

Fig. 15 is a fragmentary sectional view on the plane of the line 15—15 of Fig. 13.

Referring to Figs. 1 to 3 of the drawings, the charging or gas generating unit of this invention may comprise an elongated drop chamber formed by a tubular casing 1 having closed bottom and top end walls 2 and 3. The upper end wall 3 preferably is located a short distance down from the extreme upper end of the casing to define an auxiliary mixing chamber 4, as will be brought out clearly later herein. The upper end of the casing 1 has a radially projecting, supporting flange 5 thereon. The casing 1, above the upper end wall 3 has a plurality of discharge openings 6 therein.

A fire extinguisher of a usual inversion operated wall-mounting type, has a usual fluid reservoir 7, see Fig. 3. These fluid reservoirs may be of varied internal diameter at the neck portion 8, depending upon the manufacturer. Therefore I may provide an auxiliary flange member 9, in the form of a washer adapted to fit about the tubular casing 1, with its outer edge resting upon the neck 8 of its inner edge supporting the flange 5, so that the charging unit may be supported and sealed within the reservoir 7 through the agency of a screw cap or removable closure member 10. The closure cap 10 closely overlies the flange 5 to prevent upward displacement of the casing 1. In the event that the neck 8 is of smaller diameter than the outside diameter of the flange 5, the flange 5 may rest directly upon the neck 8, as will be apparent.

The drop chamber is adapted to contain a body of fluid, usually a liquid, which is capable of generating a gas upon contact by a suitable acid, and which is generally referred to herein as an acid-reacting fluid or liquid. Such fluid, for example, may be a somewhat saturated solution of sodium or ammonium carbonate, and the acid may be any suitable strong acid capable of rapid reaction with the fluid and resulting in the formation of a gas, such as sulphuric or acetic acid. Such a body of acid-reacting gas-generative fluid is indicated at 11 in Fig. 3, representation of this fluid body being omitted in all other figures of drawings.

The casing 1 is provided with a container 12 of suitable acid. The container 12 may comprise a strong walled bottle or the like provided with a body portion 13 and a neck portion 14 in which is disposed a tubular outlet member or conduit 15 of restricted cross-sectional area as compared with the body portion of the container to comprise a metering outlet opening. This outlet conduit extends away from the acid container 12 and terminates in an acid-receiving neck chamber 16 of a frangible character.

To this end the outlet conduit 15 and the chamber 16 may be formed of glass, hard wax, or other frangible material as in the form of tubing. The conduit extends away from the acid container to an extent such that the internal volume of the acid-receiving neck chamber 16 is relatively large as compared with the unit cross section of the passage 15, the function of which will be brought out in the ensuing description of the operation of the device.

In order to prevent undesired impact of the frangible neck chamber portion 16 against the walls of the casing 1, as during transit, shipment, handling, etc., means preferably are provided for immobilizing the acid container 12 in fixed relation to one of the end walls of the drop chamber, such as the end wall 3. In the form of the invention illustrated in Figs. 1 to 3, such means comprises three mounting screws 17, threaded through openings in the upper end wall 3, and threadedly engaging a collar member 18 which is clamped upon, or otherwise secured around, the upper portion 14 of the acid container 12.

The mounting screws 17 preferably are provided with elongated integrally secured head portions 19 which extend materially above the flanged upper end portion 5 of the casing 1, in a position to interfere with the application of the removable closure 10 to the reservoir 7. Therefore, removal of the screws 17 to release the acid container 12 will be necessitated before the unit 1 can be disposed within the reservoir 7 and the closure 10 applied.

In the position shown in Fig. 1, the gas generating unit may be considered to be in a safety or "unarmed" condition. The unit may be "armed," so that it is ready for immediate use in a fire extinguisher, by removing the screws 17 and allowing the container 12 to drop to a rest position against the closed bottom end wall 2, as indicated in Fig. 3. A plurality of plugging screws 20 may then be inserted in the holes from which the screws 17 have been removed, and tightened into place as against lead packing washers 21 so that a fluid tight seal is attained.

The specific gravity of the filled acid container is substantially greater than the amount of acid-reacting fluid which it displaces in the chamber. This is due in some measure to the weighted collar 18, although the acid filled container 12 is of sufficient specific gravity relatively to most acid-reacting fluids adapted for the present use, to operate successfully even without a weighted collar.

With the device in armed condition and the gas generating unit mounted in a fire extinguisher reservoir 7 as illustrated in Fig. 3, when the fire extinguisher reservoir 7 is inverted, the acid container 12 will drop through the liquid body 11 until the leading end of the frangible neck chamber 16 strikes the normally upper end wall 3 of the chamber. This impact results in rupture or breakage of the neck chamber 16 and the immediate discharge of the contained acid present in the frangible neck chamber 16 into the surrounding body of acid-reacting fluid 11.

The gas generating chamber preferably is sealed fluid tight when mounted in a fire extinguishing reservoir, so that the condition and quantity of the acid-reacting liquid 11 remains unchanged until the apparatus is put to use. In order to provide for the discharge under pressure, of gas generated within the drop chamber upon rupture of the neck chamber 16 as above described, and for building up rapidly a predetermined minimum initial pressure, prior to its discharge, I provide an opening 22 in the end wall 3 which normally is closed by a deformable "blow-out" plug 23. This plug is designed to be blown from the discharge opening 22 upon the development of a given superatmospheric pressure condition, for example 6 pounds p. s. i., within the drop chamber as a result of inter-

action between the acid-reacting fluid 11 and the acid from the container 12.

I further preferably provide a flow-deflecting mixing and screening member 24 over the discharge opening 22 to produce agitation and intimate intermixing of gas generating fluids issuing from the drop chamber. These results are accomplished, in the illustrated forms of the invention, by causing abrupt directional changes past thin edged members in the discharge flow of fluids from the drop chamber. The member 24 also prevents particles of glass, resulting from the rupture of the neck chamber 16, from entering the opening 22 in a clogging relation.

The flow-directing screening and mixing member 24 conveniently may comprise a disc portion 24*a*, arranged in inwardly spaced, parallel relation to the wall 3, and maintained in such spaced relation by legs 24*b* which may be formed integrally with the member 24, and welded, soldered, or otherwise secured to the chamber end wall 3.

Upon generation of a sufficient gas pressure within the drop chamber, for example 6 pounds p. s. i., the pressure releasable plug 23 will be blown out of its opening, and some unreacted commingled gas-generating fluid-acid mixture will be forced outwardly through the discharge opening 22 into the auxiliary mixing chamber 4. When the fire extinguisher is first inverted this chamber 4 will be filled through the openings 6, with the extinguishing liquid from the reservoir 7. However this extinguisher liquid will be driven from the auxiliary chamber 4 through the openings 6 when the plug 23 is blown out, and thereafter during the gas-generating process this chamber serves as an auxiliary mixing chamber for continuing the gas forming reaction of the acid-fluid mixture before it is ejected, along with the gas thus formed, through the openings 6 into the reservoir 7. Since the fire extinguishing fluids most commonly used are largely water, this auxiliary chamber 4 tends to prevent early dilution of the gas forming fluids before their reaction has been completed.

Discharge of the gas under pressure from the auxiliary mixing chamber 4 through the openings 6 into the reservoir 7, produces a pressure head upon the body 25 of water or other fire extinguishing fluid present in the reservoir 7. This fire extinguishing fluid is then forced out of the reservoir 7 by the produced pressure in a usual manner, as through a discharge conduit 28, which preferably is provided with a customary form of flow-directing nozzle or hose.

The directional changes made by the liquid-gas mixture in passing the flow deflecting, mixing and screening member 24 before and after being discharged through the opening 22, produce eddy currents and cavitation in the discharged fluids, causing a most intimate and thorough mixing of any unreacted liquids which reach the auxiliary mixing chamber 4. This pronounced commingling of the gas-generative constituents before discharge thereof into the fluid reservoir 7 further insures greatly increased reaction between the gas generating fluids.

In addition to producing a maximum gas generating reaction, this arrangement also causes a maximum amount of neutralization of the acid and the acid-reacting fluids. This neutralization reduces the possibility of strong concentrations of either of such fluids being discharged, with the extinguishing fluid, from the flow-directing nozzle.

To insure that the frangible neck chamber 16 of the container 12 will strike, as an anvil, the end wall 3 or the mixing plate 24 with sufficient force to rupture or break the frangible neck chamber 16, the collar 18 may be of lead or other relatively heavy material. The size and weight of the entire acid container assembly is subject to manufacturing control to attain the desired overall specific gravity relatively to the amount and kind of acid-reacting fluid 11 which it displaces.

In view of the fact that charged fire extinguishers are often required to be handled in an armed condition, as in transporting them to the location of a fire, some danger of premature discharge would exist from the standpoint of inadvertent partial inversion of the extinguisher if the acid container 12 were free to slide downwardly along the casing 1 with sufficient force to break the chamber 16, even though it was not intended that this should happen. For this reason I preferably provide a restraining means which will prevent such sliding of the acid container 12 toward the closed end 3 of the gas generating chamber until inverted to a desired angular position.

To this end I may provide cooperating offset means on the collar 18 and on the tubular casing 1. Such offset means on the casing 1 comprises an inwardly projecting annular bead 26 around the casing 1, at a height to lie above an outwardly extending shoulder or rim 27 on the collar 18 in a normal upright position of the extinguisher. The maximum outside diameter of the bead 27, is less than the minimum internal diameter of the casing bead 26, so that when the unit is inverted beyond a predetermined angular position, the container 12 and its collar 18 may drop freely through the casing bead 26.

With the cooperating offset structure of the type illustrated in Figs. 1 to 3, the armed extinguisher may be inverted about 45° below the horizontal before the container 12 will start to drop toward the closed end 3. At that angle the acid container will attain sufficient falling velocity by the time it reaches the closure plate 3 to insure breaking the neck chamber 16 upon striking the anvil provided by the end plate 3 or plate 24.

In the absence of a restraining means, the acid container 12 could slide slowly along the casing 1 toward the closed end wall 3 soon after the extinguisher was inverted past the horizontal. In such instance it would be possible for the acid container 12 to continue to slide slowly along the casing wall until it came gently to rest against the anvil, without rupturing the frangible neck chamber 16. The provision of the restraining means also prevents the latter undesirable possibility.

A modified arangement for suspending the gas generating unit in a fire extinguisher reservoir is illustrated in Figs. 4 and 5. In this arrangement, a top disc 30, of a size to fit on the upper edge of the filling neck of a fire extinguisher, has a pair of tabs 31 and 32 severed from the metal of the top disc itself. The disc 30 may be of steel or other suitable bendable metal, and preferably is coated with a corrosion resistant substance, such as lead. The tabs may be bent downwardly at right angles to the plane of the disc and the lower ends of the thus downwardly bent tabs may be bent outwardly and inserted through gas discharge openings 33 near the upper end of a tubular casing 34. The ends of the tabs thus projected outwardly through the openings 33 then may be bent upwardly along the outer face

of the tubular casing **34** as shown in Fig. 5. By supplying discs of this character, which are very inexpensive to manufacture, in sizes to accommodate the various diameters of neck openings of fire extinguishers of different manufacturers, the gas generating chambers can be suspended in any of the various makes of extinguishers of this type.

Figs. 6 to 10, inclusive, show a still further modified and presently preferred suspension arrangement for gas generating chambers, and also a preferred arrangement for retaining the acid container immobilized, or in an unarmed condition for safety in handling, and for shipping, prior to the time when it is desired to prepare or arm the device ready for use.

Referring first to the modified arrangement for suspending the gas generating chamber within the neck of a fire extinguisher reservoir, as shown in Figs. 6 to 10 of the drawings, many standard makes of fire extinguishers have an inwardly offset shoulder or rim **35**, see Fig. 6, within the neck portion thereof. For suspending gas generating chamber **36** in extinguishers provided with this type of neck opening, the upper marginal edge of a tubular casing **34** is bent reversely upon itself as at **37** to form a hem. A curved length of spring wire **46**, which may be of bronze, stainless steel, or steel, coated or plated with a suitable non-corrosive sheathing such as lead, is curved to the shape indicated in dot-dash lines in Fig. 10. This wire then is secured around the upper end of the casing **34** immediately below the hem **37**, as by spot welding it to the casing **34** as shown at **61** in Fig. 10. The terminal ends **62** and **63** of this curved length of spring wire are bent upwardly at right angles as shown in Fig. 9 so that these upwardly bent end portions may be grasped between the thumb and finger of an operator, or by means of a suitable tool such as a pair of pliers, to draw the ends inwardly toward each other. This decreases the diameter of the loop described by the wire as the parts move toward the solid line position of Fig. 10. This drawing together of the ends is done to permit insertion of the spring suspension member in the neck of a fire extinguisher reservoir. Once the spring suspension member has entered the neck of the extinguisher, the ends may be released to permit them to spring outwardly into engagement with the inner wall of the neck opening. This action forces the side of the casing **34** opposite the ends of the spring wire into engagement with the rim or shoulder **35**, and thus forms an adequate suspension for the gas generating chamber. Since the gas generating chamber is immersed in the fire extinguishing liquid when mounted in a fire extinguisher reservoir, the suspension stresses are not great. The spring wire method of suspension therefore is adequate, and presently is the preferred form of this phase of the invention.

Figs. 6, 7 and 8 also illustrate a preferred arrangement for immobilizing the acid container for retaining the apparatus in unarmed or safety condition.

As shown in Fig. 6, an acid container **38** has an annular collar **39** with a central opening of a size to receive a frangible neck portion **40** of the acid container. The under side of the annular collar **39** is recessed to conform to the shape of the upper end of the acid container. This annular collar is secured to the container as by a suitable adhesive, such as sodium silicate or water glass. An annular groove **41** is formed in the top surface of the annular collar **39**, the sides of the groove being beveled outwardly so as to guide the lower end of a securing pin **42** therein when the pin is screwed downwardly toward groove. The upper end of the securing pin **42** is inserted and secured in an axial opening in the shank of a screw **43**, which may be threadedly inserted in an opening in a top end plate **44**. This top plate is substantially similar to the top plate **3** shown in Figs. 1 and 2, and described previously herein, except that it is provided with a marginal bevel on its upper side as at **45** to facilitate soldering the top plate in place in the tubular casing. The head of the retaining pin screw **43** preferably is colored a distinctive color, such as bright red, so that it can be easily distinguished from a sealing screw **47**, see Fig. 8, which preferably is left in the natural color of the metal from which it is made, or with which it is plated, for example—cadmium or lead color. If desired these colorings may be reversed, or other distinctive colors employed. A sealing washer **48** which may be of lead is provided beneath the screws **43** and **47** to hermetically seal the screw opening in the gas generating chamber **36**.

A central discharge opening **49** is sealed with a pressure blow-out plug **50**, and is provided with a flow deflecting plate **51** similar to the plate **24** illustrated in Figs. 1 and 2 and described previously herein.

The annular collar **39** on the acid container has a radially projecting shoulder **52** which is adapted to engage an inwardly offset beaded flange **53** formed in the wall of the casing **34** in the same manner as described previously herein for the shoulder **27** and bead **26**.

In the form illustrated in Fig. 6, the safety retaining pin **42** preferably is of a length to have its lower end at or below the plane of the bead **53** when inserted to a safety retaining position as shown in Fig. 6. Therefore, if the safety retaining pin should inadvertently miss its annular groove **41** in the top of the collar **39**, due for example to the safety retaining pin being bent, and the pin should be screwed down with its lower end outside of the collar **39** as indicated in dot-dash lines in Fig. 6, it still would prevent the shoulder **52** from passing the bead **53**, and thus, in case of inadvertent inversion of the unit, would prevent the acid container from accidentally dropping down to fracture the neck portion **40** and initiate a gas generating process.

A modified form of frangible neck chamber and acid container is shown in Fig. 11. In this instance, an acid container **54** comprises a relatively heavy walled glass bottle with a short heavy walled neck outlet **55**. The internal diameter of the neck outlet is of a preferred size for metering the flow of acid from the bottle during a gas generating operation. A neck chamber portion **57** comprises a length of thin walled preferably precision glass tubing, which is joined, as by fusion, to the neck outlet of the acid bottle to be co-extensive therewith. This length of tubing may be of a length indicated in dot-dash lines **57*a*** in Fig. 6.

After the bottle has been filled with acid to a required depth, such, for example, as indicated in Fig. 11, the upper end of the tubing is fused and drawn off to form a pointed heat seal as shown in Fig. 6. Thin walled glass tubing of this nature, is readily available. Therefore, a frangible neck chamber having walls of sufficient thinness to secure any desired fracturing characteristics can be very easily attained.

By forming the neck chamber with a pointed

striking end adapted to contact the anvil upon inversion of the chamber, the impact stresses are concentrated at a single point of impact which further insures fracture of the chamber. Even though the fracture should be so slight as to cause only a mere cracking of the frangible wall of the neck chamber, the interaction between the acid-reacting fluid seeping into such crack, and the acid in the bottle will generate gas in the acid container and will blow the cracked neck container portion apart to free the contents of the acid container.

Fracturing of the neck chamber, however, does not extend to the acid bottle, no matter how directly the impact on the anvil may be, since the fracturing of the neck chamber uniformly results in its destruction down to a point slightly above the ring of fusion with the acid container. The sudden release of the contents of the neck chamber into the surrounding acid-reacting liquid causes an instant gas forming reaction which cushions the fall of the acid container and prevents impact on the container itself. Thus a uniform fracture, and resultant gas generating reaction is assured at all times, regardless of the method of manipulation of the extinguisher. The present arrangement therefore insures a high degree of accuracy and uniformity, with a minimum of cost and expensive apparatus, which otherwise would be necessary to secure adequate control of the fracturing and gas forming characteristics. Uniform fracturing characteristics are, of course, an essential factor in a device of this character, and yet, as previously mentioned, a definite cost ceiling exists in the market for them.

Fig. 12 shows a further modified form of collar for the acid receptacle. As mentioned previously herein, a weighted collar for the acid container is not essential, providing the specific gravity of the filled acid container is sufficiently great, relatively to the acid-reacting liquid in which it is immersed to insure, upon inversion, fracture of the frangible neck chamber 57 of the acid container.

The collar shown in Fig. 12 may be used when no additional weight is required. This collar comprises an inverted cup-shaped annular member **58** having outwardly bent flange **59** around its lower end which projects outwardly a distance sufficient to engage the restraining bead **53'** in the same manner as the shoulder **52**, previously described in connection with the arrangement of Fig. 6. The top of the inverted cup-shaped collar **58** has an annular recess **60** therein which acts in the same manner as the annular groove **41** to receive the lower end of a safety immobilizing pin **42'**.

The lateral clearance in this arrangement between the flange **59** and the bead **53'** preferably is similar to that described in connection with the arrangement of Fig. 6 so as to insure against dropping of the acid container upon inversion of the device with the safety retaining pin in place, in the event the lower end of the safety retaining pin should be inadvertently deflected to the dot-dash line position of Fig. 12.

In the modified arrangement shown in Figs. 13, 14 and 15, a spring bottom support is provided for the gas generating unit. This arrangement has been found preferable for use where the unit is to be subjected to substantial amounts of vibration, for example for installation in motor trucks and buses.

In this modification a container and gas generating unit similar to that shown in Fig. 6 may be used, and the same reference numerals used in the structure of Fig. 3 will be employed in connection with the description of the modification of Figs. 13 to 15 as far as such numerals apply. A mild spring wire **67** has its upper end formed to the shape shown in dotted lines in Fig. 15. The upper end of the wire **67** is inserted in one of the discharge openings **33** near the upper end of the casing **34**, and out through the opening **33** adjacent thereto. A projecting end portion **68** of the wire, indicated in dot-dash lines in Fig. 15, then is bent inwardly as by means of a pair of pliers, to lie flush along the outer side of the casing as shown in solid lines to secure the upper end of the wire to the casing. The wire then is carried down along the side of the casing as at **69** and is formed into a single loop **70**, preferably in the form of a half hitch as illustrated, around the lower end of the casing. The wire is then wound in the form of a flat helix **71**, as shown in Fig. 14 close to the bottom of the casing **34**.

When it is desired to mount the unit in a fire extinguisher, the small central loop **72** of the flat helical spring is grasped by a suitable tool, for example a pair of pliers, and is drawn outwardly, axially of the casing **34** to extend the spring. The spring is thus extended to a predetermined length, which may be printed in instructions included with the chamber assembly. This spring length is such that when the gas generating unit is mounted in a fire extinguisher reservoir **7** as shown in Fig. 13, the gas generating unit will be pressed by the spring upwardly against the closure cap.

A gasket **73**, mounted between the closure cap **10** and the neck of the reservoir **7**, preferably is of a width to extend inwardly and overlie the upper edge of the gas generator casing **34**. This provides a cushion for the casing which prevents metal-to-metal contact and reduces rattles which otherwise might be caused by vibration in a vehicle in which the extinguisher was installed.

While I have illustrated a preferred form of my invention, and some preferred modifications thereof, it will be apparent to those familiar with the art that the arrangement is capable of other modifications without departing from the invention. It is desired, therefore, not to limit the invention except as set forth in the following claims.

I claim:

1. A gas generating unit for an inversion operated fire extinguisher having an extinguisher reservoir with a top neck opening therein and a removable closure cap for sealing said neck opening, said unit comprising; an elongated gas chamber insertible in said neck opening, to be retained therein by said closure cap, support means carried by said chamber and having support engagement with said reservoir adjacent said neck opening, said chamber having a discharge opening into said reservoir, a blow-out closure plate sealing said discharge opening and adapted to be blown clear of said opening on the attainment of a predetermined pressure in said chamber, a flow diverting plate of larger diameter than said discharge opening mounted with its marginal edge laterally beyond and in slight inwardly spaced relation from said discharge opening, an acid filled hermetically sealed container mounted in said chamber normally to be free for movement lengthwise therein, said container having an easily frangible portion adapted to be fractured

on an inversion of said chamber to release the acid from said container, and a quantity of acid-reacting fluid in said chamber, said acid-reacting fluid being of lesser specific gravity than the acid filled container, to react with said acid to produce gas, the gas thus produced driving the contents of the chamber around the marginal edge of said flow diverting plate and out the discharge opening to produce an eddy flow with cavitational effect for maximum intermixing of the acid and acid-reacting fluid at and beyond the discharge opening.

2. A gas generating unit for an inversion operated fire extinguisher having an extinguisher reservoir with a top neck opening therein and a removable closure cap for sealing said neck opening, said unit comprising; an elongated gas chamber insertible in said neck opening, to be retained therein by said closure cap, support means carried by said chamber and having support engagement with said reservoir, said chamber having a discharge opening into said reservoir, a flow diverting plate of larger diameter than said discharge opening mounted within said chamber inwardly of said discharge opening with its marginal edge in slightly spaced relation from said discharge opening, an acid filled container mounted in said chamber, means for releasing the acid from said container, and a quantity of acid-reacting material in said chamber, to react therein with said acid to produce gas within said chamber, the gas thus produced driving the contents of the chamber around the marginal edge of said flow diverting plate and out the discharge opening to produce an eddy flow with cavitational effect for maximum intermixing of the discharged acid and the acid-reacting material at and beyond the discharge opening.

3. A gas generating unit adapted for installation within a fire extinguisher fluid reservoir, said unit comprising: an elongated tubular casing provided with a discharge opening at one end thereof normally closed by a pressure sealing member adapted to maintain said casing fluid-tight under normal pressure conditions within said casing, and to unseal said discharge opening upon the development of a given superatmospheric pressure within said casing; a hermetically sealed container within said casing holding a quantity of acid in liquid form, said container including a portion adapted in use to release said acid into said casing; a body of gas-generative liquid within said casing, said liquid being chemically reactive with said acid to produce a gas; and a flow-directing baffle member within said casing, said baffle member being superimposed over and closely spaced inwardly from said discharge opening.

4. A gas generating unit for an inversion operated fire extinguisher having a pressure reservoir with a top opening therein and a closure cap for sealing said opening, said unit comprising: a cylindrical casing insertible in said top opening, a pair of end wall members in sealing marginal relation with the tubular casing to form a gas generating drop chamber, the upper end of the casing having support engagement with the reservoir marginally of said top opening therein, the upper end wall member being spaced downwardly from the closure cap a substantial distance to form a mixing chamber therebetween, the casing above the upper end member having a plurality of openings communicating with said reservoir, a discharge opening in the upper end wall of the unit, pressure releasable means normally sealing said discharge opening, and quantities of acid and of acid-reacting material mounted in normally separated condition in said chamber, said acid and acid-reacting material being adapted to intermix to form gas on inversion of the unit.

5. A gas generating unit for an inversion operated fire extinguisher having a pressure reservoir with a top opening therein and a closure cap for sealing said opening, said unit comprising: a gas generating chamber insertible in said top opening, the chamber having support engagement with the reservoir, a discharge opening near the upper end of the unit, pressure releasable means normally sealing said discharge opening, a mixing chamber enclosure exteriorly of said discharge opening, another opening from said mixing chamber into said reservoir, and quantities of acid and of acid-reacting material mounted in normally separated condition in said chamber, said acid and acid-reacting material being adapted to intermix to form gas on inversion of the unit.

6. A gas generating unit for an inversion operated fire extinguisher having a pressure reservoir with a top opening therein and a removable closure cap for sealing said opening, said unit comprising: a chamber having an anvil surface exposed interiorly of one end thereof, the chamber being adapted for mounting in said reservoir, a supply of acid-reacting liquid in said chamber, an acid container in said chamber, said acid filled container being free for guided movement axially of said chamber, said acid container being non-easily-frangible with a metering neck opening therein, and an easily frangible neck chamber hermetically sealed to said container around said metering neck opening and in open communication with the interior of said acid filled container, the neck chamber being positioned to strike the anvil for self destruction on an inversion of the unit thereby suddenly to release the contents of the neck chamber into the surrounding acid-reacting liquid, and simultaneously to expose the metering neck opening in the acid filled container.

7. A gas generating unit for an inversion operated fire extinguisher having a pressure reservoir with a top opening therein and a removable closure cap for sealing said opening, said unit comprising: a chamber having an anvil surface exposed interiorly of an end thereof, the chamber being adapted for mounting in said reservoir top opening with the anvil end uppermost, a supply of acid-reacting liquid in said chamber, an acid container in said chamber, said acid filled container being free for guided movement axially of said chamber, said acid container being non-easily-frangible with a metering neck opening therein, an easily frangible neck chamber hermetically sealed to said container around said metering neck opening and in open communication with the interior of said acid filled container, a weighted collar surrounding said neck opening and having a recess adapted to receive the upper end of the acid container, and secured to said acid container, the neck chamber being positioned to strike the anvil for self destruction on a dropping of the acid container upon an inversion of the unit, thereby suddenly to release the contents of the neck chamber into the surrounding acid-reacting liquid, to generate a relatively large amount of gas between the weighted collar and the anvil end of said chamber to cushion further dropping of the acid container, and simultaneous-

ly to expose the metering neck openings in the acid filled container.

8. In an inversion operated fire extinguisher, a gas generator unit comprising an elongated drop chamber of substantially uniform cross section, hermetically sealed, and having a blow-out closure in a wall thereof, an anvil surface at the upper end of said chamber, said chamber being substantially filled with an acid-reacting liquid, an acid filled bottle of relatively heavy walled glass with a metered neck opening in the top thereof, a length of thin walled glass tubing having its lower end fused to the bottle around said neck opening to extend upwardly therefrom, and having its upper end fused and drawn out to seal the tube in a point, the portion formed by said tubing comprising a neck chamber open to the acid in the bottle and comprising an easily frangible chamber for a starting charge upon fracture of said neck chamber, said acid filled bottle being adapted to drop through said fluid to strike the point of said neck chamber against the anvil for fracture of the neck chamber upon inversion of the unit.

9. A gas generating unit adapted for installation within a fire extinguisher fluid reservoir, which comprises: an elongated tubular casing provided with a discharge opening at one end thereof normally closed by a pressure sealing member adapted to maintain said casing fluid-tight under normal pressure conditions within said casing and to unseal said discharge opening upon the development of a given superatmospheric pressure within said casing; a hermetically sealed container member within said casing holding a quantity of acid in liquid form, said container member including a frangible portion adapted to be fractured in use and release said acid into said casing, said container member being movably mounted within said casing and provided with a weighting element attached thereto, said weighting element comprising a collar surrounding the frangible portion and having a recess therein shaped to receive the upper end portion of the acid container fittedly therein with the frangible portion extending beyond said collar.

10. A replaceable gas generating unit for an inversion operated fire extinguisher comprising a liquid filled pressure reservoir having a top opening and a sealing closure cap therefor, the inner wall of said reservoir surrounding said opening having a step support thereon, the gas generating unit comprising a cylindrical chamber insertible in said top opening, said cylindrical chamber having a single open ended loop of spring wire secured, at a central portion thereof, to the upper end of the chamber, to rest on said step support, the ends of the wire loop being free and outwardly spring pressed to engage the side wall around the top opening, thereby to press the chamber toward the step support on the side opposite said wire ends.

11. The arrangement set forth in claim 10 wherein the ends of the wire are bent upwardly at substantially right angles to facilitate reduction of diameter of the wire loop.

12. A replaceable gas generating unit for an inversion operated fire extinguisher comprising a liquid filled pressure reservoir having a top opening and a sealing closure cap therefor, the gas generating unit comprising a cylindrical chamber insertible in said top opening, said cylindrical chamber having a spring wire secured to an end thereof and having resilient supporting engagement with said reservoir to retain said chamber in upwardly supported position in said top opening and adjacent said closure cap.

13. A replaceable gas generating unit for an inversion operated fire extinguisher comprising a liquid filled pressure reservoir having a top opening and a sealing closure cap therefor, the gas generating unit comprising a cylindrical chamber insertible in said top opening, said cylindrical chamber having an opening near the upper end thereof, a spring wire having hooked engagement with said chamber through said opening, and having looped engagement with said chamber, said wire extending downwardly below the lower end of said chamber, the portion of said wire below said chamber being formed in a coil adapted resiliently to engage a reservoir element opposite said top opening for support of said unit adjacent said closure cap in said reservoir top opening.

14. The arrangement set forth in claim 13 wherein the spring wire is of a mild deformable character, formed in a flat helix beneath said chamber, and is adapted to be elongated by stretching prior to insertion in said reservoir top opening.

15. A gas generating unit removably insertible in an inversion operated fire extinguisher, said unit comprising: an elongated chamber adapted to hold a supply of acid-reacting fluid, anvil means mounted interiorly of an end of said chamber, an acid container in said chamber having an easily frangible portion opposite said anvil, said acid container normally being freely movable lengthwise of said chamber, safety means removably mounted on said chamber to extend interiorly thereof into engaging relation with said acid container to limit movement of said acid container toward said anvil, said safety means being removable to free the acid container for movement toward the anvil, and an indicating member adapted to be replaceably mounted on said chamber in place of said safety means, and positioned beyond the path of movement of the acid container, said replaceable member being of a predetermined visually distinctively different character from the safety means.

16. In a gas generating unit adapted for installation within a fluid reservoir of a fire extinguisher, said unit comprising an elongated tubular casing provided with transverse wall members at its respective ends, one transverse wall member at one end thereof being provided with a discharge opening normally closed by a pressure sealing member adapted to maintain said casing fluid-tight under normal pressure conditions within said casing and to unseal said discharge opening upon the development of a given superatmospheric pressure within said casing; a hermetically sealed acid filled container within said casing, said container being adapted to be opened by a movement of the acid container in the casing to release said acid into said casing; a body of gas-generative liquid within said casing, said liquid being chemically reactive with said acid to produce a gas; a plurality of attachment members threadedly mounted in said one wall member and extending interiorly of said casing into threaded engagement with said container to immobilize said container relatively to said one wall member and adapted for removal from said wall member and from said container to release said container member for free movement within said casing, at least one of said threaded attachment members having a portion projecting outwardly beyond the end of said cas-

ing into a position such as to preclude the installation of such unit within such fluid reservoir.

17. A gas generating unit installed in the top opening of an inversion operated fire extinguisher reservoir having a closure cap therefor, said unit comprising: an elongated tubular casing provided with anvil means and adapted to hold a body of gas-generative fluid, an acid container disposed within said casing and provided with a frangible portion axially opposite said anvil, said acid container being movable longitudinally within said casing in a direction toward the anvil to rupture said frangible portion upon a predetermined inversion of said casing; and safety means mounted on said casing and having a portion extending into the interior thereof in position to engage and substantially immobilize said acid container in a position to hold said frangible portion of said container and said anvil out of contact with one another in all positions of said casing, said safety means including a portion projecting outwardly past an end of said casing and outwardly through said reservoir top opening to preclude the inadvertent installation of the closure cap on said top reservoir opening over the unit with the acid container engaged and held in a safety immobilized condition, said safety means being removable to de-immobilize said acid container and to free the top opening for the mounting of said closure cap.

18. A normally upright gas generating unit removably inserted in an inversion operated fire extinguisher, said unit comprising: an elongated drop chamber adapted to hold a supply of acid-reacting liquid, anvil means mounted interiorly of an end thereof, an acid container in said chamber and having an easily frangible portion facing said anvil, said acid container normally being freely movable lengthwise of said chamber, a shoulder carried by said acid container to extend radially outwardly beyond the acid container, and an inwardly extending abutment on the interior of said drop chamber above the normal level of the shoulder on the acid container therein, thereby to restrain movement of the container along the chamber wall upon a partial inversion of said drop chamber, and to free the container for falling movement upon inversion of said drop chamber beyond a predetermined angular position of inversion.

19. A normally upright gas generating unit adapted for mounting in an inversion operated fire extinguisher, said unit comprising an elongated drop chamber adapted to hold a supply of acid-reacting liquid, anvil means mounted interiorly of one end thereof, an acid container having an easily frangible portion facing said anvil, said acid container normally being freely movable longitudinally of said chamber, said acid container having a shoulder facing toward said one end, removable positioning means in said one end adapted to abut said shoulder to retain the acid container against displacement until said pin is removed, a chamber wall portion adjacent said shoulder being offset to engage said shoulder and restrain said acid container against movement longitudinally of said chamber until the chamber is tilted beyond a predetermined angle of inversion.

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