June 4, 1929. A. C. BADGER 1,715,347

FIRE EXTINGUISHER

Filed Oct. 22, 1926

Fig. 1

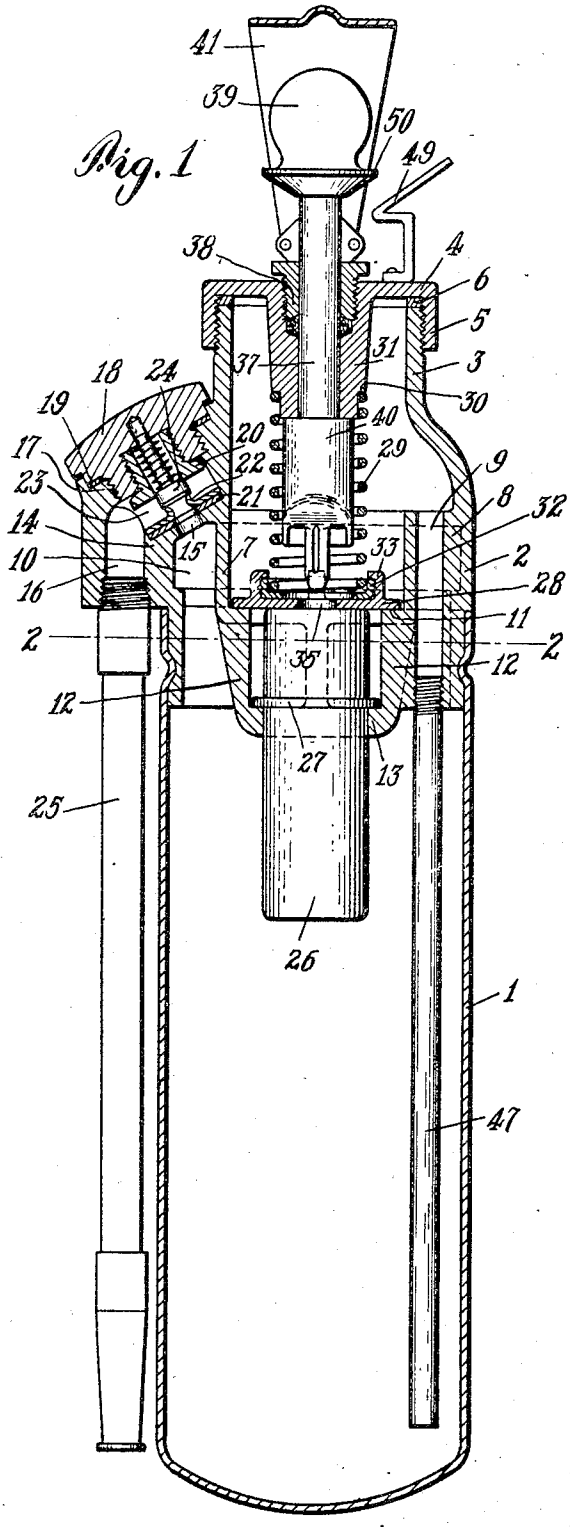


Fig. 2

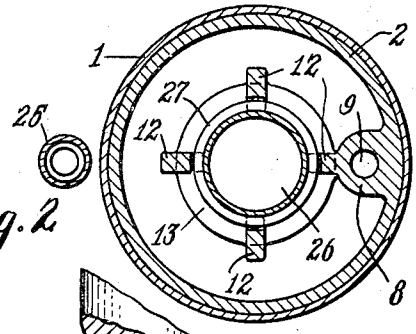


Fig. 3

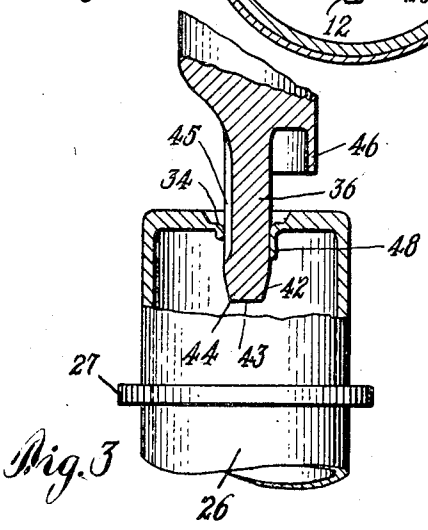
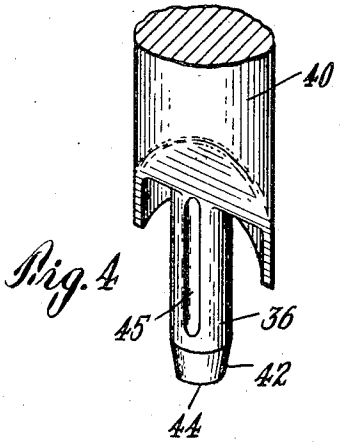


Fig. 4



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UNITED STATES PATENT OFFICE.

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FIRE EXTINGUISHER.

Application filed October 22, 1926. Serial No. 143,410.

The present invention relates to portable fire extinguishers of the type in which pressure to expel the extinguishing liquid is applied by gas under pressure which is confined initially, either in the gaseous state or in the compressed and liquefied state, in a closed and hermetically sealed cartridge, and is released at the time of use by puncturing the cartridge. More particularly, it relates to extinguishers of this type which are adapted to be inverted when the gas holding cartridge is punctured, and to be held in the inverted position while in use. The objects of the invention are to arrange and support the gas holding cartridge in such manner that it will be enveloped in the extinguishing liquid and in a position to receive heat therefrom substantially throughout the entire period of discharge, whereby to prevent such chilling of the contents of the cartridge, owing to expansion, as would cause a part of such contents to freeze, when used under low temperature conditions; and to provide an improved means for puncturing the cartridge and maintaining an open passage of prescribed and invariable area for escape of the confined gas.

The manner in which these objects are accomplished and the essential characteristics of the invention are fully disclosed in the following specification with reference to the drawings, which respectively describe and illustrate the now preferred embodiment.

In the drawings,—

Fig. 1 is a vertical central section of a fire extinguisher containing this invention;

Fig. 2 is a cross section on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary detail section on a larger scale illustrating the action of the punch element of the apparatus in puncturing and opening the gas cartridge;

Fig. 4 is a perspective view of the punch.

Like reference characters designate the same parts in all the figures wherever they occur.

The casing or body of the extinguisher consists of a shell 1, which may be made of drawn or otherwise fabricated sheet metal, or of other construction, in any desired proportions or dimensions, and a head 2. The latter is preferably constructed as a metal casting suitably formed and dimensioned at one end to enter the shell 1 and be secured thereto, and formed with a neck 3 at the other end, which may be contracted in diameter, and is preferably screw threaded externally to receive a cover cap 4 having an internally threaded lip or flange 5. The removal of the cover cap opens the extinguisher body to receive the charge of extinguishing liquid and the gas cartridge. When the cover cap is applied, it is preferably made tight by a packing washer or gasket 6.

In the central part of the head there is an interior annular wall 7 connected with the outer wall of the head at one side by a web 8 in which there is a passage 9, and throughout the circuit of its upper edge by a continuous web 14. Beneath the web 14 there is an annular space 10 between the inner and outer walls which is continuous except where it is interrupted by the web 8. At the lower extremity of the inner wall 7 is an interior shoulder or ledge 11, and from the lower end of this wall project downwardly four, more or less, arms 12, separated by intermediate spaces open to the space 10, and connected together at their lower ends by a ring 13 which furnishes an internal shoulder of less interior diameter than the shoulder 11. Those parts of the ring 13 which adjoin the arms 12 form, in effect, hooks or ledges on the lower ends of such arms.

The outer wall of the head at one side is enlarged or formed with a boss in which are a valve chamber and discharge passage 16, and a tapped hole 17 into which a screw plug 18 carrying a valve may be mounted. A hole 15 is formed in the web 14 to connect this valve chamber with the annular space 10. The outer surface of the head is recessed and faced off in complement to a shoulder 19 on the plug so as to receive this shoulder and an intermediate packing gasket.

A valve casing 20 is screwed into a recess in the plug 18 and its inner end is forced by the plug 18 against a washer or gasket 21 supported by the outer surface of the web 14. In the valve casing is a passage in line with hole 15 and surrounded by a valve seat 22, and a transverse passage 23 into which this passage opens and which leads to the discharge passage 16 in the head. A spring pressed valve 24 is mounted in the valve casing and is normally held by its spring against the seat 22 to prevent accidental loss of the extinguishing liquid by evaporation, or otherwise.

A hose 25 may be screwed into the tapped orifice of the discharge passage 16, for the usual purpose of directing the liquid when discharged.

The abutment ring or shoulder 13 previously mentioned is adapted to support a cartridge 26 by means of a shoulder 27 formed or applied externally on the cartridge. The dimensions of the several parts of the head, and of the cartridge, are such that the cartridge may be inserted through the neck 3 when the cover cap is removed and may be passed through the inner wall 7 and the shoulder 11 thereof and onward until the shoulder 27 brings up against the abutment ring 13. The cartridge is then retained in place by a follower or retainer plate 28, which is adapted to rest on the shoulder 11 and is pressed toward the same by a spring 29. The length of the cartridge above its shoulder 27 is substantially equal to the distance between the shoulders 11 and 13, so that the retainer plate 28 may bear squarely and firmly on the shoulder 11, and at the same time bear tightly enough on the cartridge also, or lie so close to the cartridge as, in connection with the liquid seal formed as hereinafter described, to prevent any substantial leakage of gas between the cartridge and plate, and cause the gas to flow through a hole 35 in the plate out of contact with the extinguishing liquid, when the cartridge is discharged.

The spring 29 reacts against a shoulder 30 formed on the exterior of a guide sleeve 31 which projects inward from the cover cap 4 and provides a bearing for the punch later described. The upper end of the spring preferably surrounds the end part of this sleeve and is coiled about it so tightly as to be thereby, in effect, united to the sleeve; or it may be secured otherwise. The lower end of the spring rests on, and is preferably soldered to, a ring 32 which rests freely on the retainer plate 28 and is confined between four, more or less, lugs or hooks 33 on the plate. The ring 32 is provided as a freely rotatable bearing member to permit rotation of the spring as the cover cap is screwed into place, so that the spring will not be distorted thereby.

The cartridge 26 holds the charge of compressed fluid which serves to expel the extinguishing liquid when the extinguisher is put to use. I prefer to fill the cartridge with liquefied carbon dioxide under high pressure. I may, however, use any other highly compressed gas in the gaseous or liquid state. By the use of the term "gas" in this specification, I mean and include those substances which are gaseous at ordinary atmospheric pressure and temperatures and which, although they may be liquefied under abnormal conditions, revert to the gaseous state when released from confinement at temperatures approximating the ordinary atmospheric temperatures.

The cartridge is preferably made of iron or steel having an initially separate body and cap united by butt welding after filling with the compressed gas, as explained in my prior applications for Letters Patent, Serial No. 692,468, filed February 13, 1924, and Serial No. 64,047, filed October 21, 1925. The shoulder 27 may be formed by the metal which is bulged out at the welded joint and afterwards properly shaped, or it may be formed or applied otherwise. The walls of the cartridge are thick and strong enough to withstand the pressure of the confined charge and to resist damage from other causes, but in the end wall of the cartridge next to the retainer plate 28 is a small area 34 where the wall is reduced in thickness so that it may be penetrated by a punch to release the confined charge. This reduced area is preferably in the center of the end wall; and in the corresponding part of the retainer plate is a hole 35 to permit passage of the punch and of the escaping gas.

The punch above referred to is designated by the numeral 36. It is provided on the inner end of a stem 37, mounted slidably in the guide sleeve 31 of the cover cap and passing through a stuffing box 38 in the outer end of said guide, and having a terminal 39 capable of being struck or pushed upon to force the punch toward the cartridge. Normally it is withdrawn from the cartridge, where it is retained by the friction of the stuffing box packing, although it may rest on the cartridge, but is prevented by an enlarged part 40 on the stem from being wholly withdrawn through the cover cap. The part designated 41 is a guard bail which normally passes across the outer end of the punch stem to prevent accidental inward driving thereof, but it may be turned aside when occasion arises for operating the punch.

The punch 36 is designed to cut a hole in the adjacent wall of the gas cartridge, while leaving an integral attachment at one side between the part cut out and the wall, and then to enlarge and completely fill the hole except for a passage of the proper size to permit discharge of the gas at a predetermined rate. The major part of the punch is of uniform cross section, preferably cylindrical, but its extreme end portion is slightly tapered at 42. It has an end face 43 of nearly as large area as the cylindrical part, between which and the tapered sides is a distinct edge 44 made as a cutting edge, except for a limited part at one side, where it is dull. The end face 43 is preferably flat, as I have found that the cutting edge made between such a face and the sides of the punch remains sharp and in good cutting condition longer and after more uses than when made in any other way. The taper of the punch extremity is not great enough to make it pointed, or even nearly so, and is only enough to make the cutting extremity smaller than the adjacent part of the punch

in the degree which insures that the punch will fill and expand the cut out hole, and make such tight engagement with the rim of the hole so as to prevent any substantial leakage of gas around the punch, but will not enlarge the hole enough to break or tear its rim and so make an unduly large passage through which the gas may escape.

The gas outlet passage is provided by a groove 45 at one side of the straight part, that is, wholly above the tapered zone, and of suitable length to cross the wall of the cartridge after the penetration of the punch therethrough as far as it will go. The dimensions of the opening bounded by this groove and the side of the hole in the cartridge wall which crosses it are of exactly known values, so that a passage of the same size is opened in all cartridges, permitting outflow of the gas at a rate which has been determined as best suited to maintain flow of the extinguishing liquid throughout the whole period of discharge thereof with projection of the stream to a given distance, and without either imposing too much pressure at the beginning, or causing the pressure to become too small at the end of the discharging period. A lip or shoulder 46 beside the punch is adapted to limit penetration of the punch into the cartridge, and it is located where it will so arrest the punch before the upper end of the groove can be advanced into the cartridge and obstructed by the wall thereof. The punch and its stem are further constructed so as to leave the grooved side without any obstructions which would oppose outflow of the gas.

A tube 47 is set into the passage 9 and extends well toward the bottom of the extinguisher shell for the purpose of conducting liberated gas, when the extinguisher is inverted and put to use, through the liquid without mixing with it, and causing the gas to exert pressure directly on the exposed surface of the liquid which is then uppermost.

In charging the extinguisher, the extinguishing liquid is first poured into the open mouth when the cover has been removed and before the cartridge has been inserted. Any suitable liquid may be used for this purpose, including water, but for extinguishers liable to be exposed to temperatures below the freezing point of water, I prefer to use a non-freezing liquid, for instance carbon tetrachloride, or a non-freezing solution of water and a salt, for instance, calcium chloride. Enough liquid is thus poured into the extinguisher to fill it to a point where the gas cartridge will be wholly or largely submerged. That is, the extinguisher may be filled nearly to the level of the shoulder 11. Then the gas cartridge is inserted and the cover cap, carrying the punch and the cartridge retainer 28 and its spring 29, is applied and made tight. Owing to the connection of the spring to the guide sleeve and cartridge retainer, these parts are removable and applicable to the extinguisher with the cover cap as a unit.

In use, the extinguisher is inverted and the punch forced inward, after the guard bail 41 has been moved aside to leave the end of the punch free for striking it. The cutting end of the punch penetrates the thin part of the adjacent cartridge wall, completely severing the major part of a disk 48 from this wall by means of the cutting edge 44, and partially severing it at the side where the punch is left dull, leaving the disk attached to the cartridge wall at this side. The tapered zone 42 of the punch enlarges the hole slightly, and the straight part of the punch immediately following comes into close and tight engagement with the rim of the hole, preventing any appreciable leakage of the gas around it and providing the groove 45 as the only channel through which the gas may flow. The friction between the punch and the rim of the hole is usually enough to prevent the pressure of the gas from blowing the punch out of the hole, but if additional security for this purpose is needed, a lock of any suitable sort may be provided, conveniently a spring latch 49 mounted on the outside of the cover cap and adapted to spring over a shoulder 50 on the punch stem and interlock therewith in a manner which will be readily apparent from the drawing. At the same time, the lip 46 of the punch may strike the retainer plate 28, and press it more firmly against the cartridge end, where it is held by its latch 49. And the liquid in the extinguisher body which, on inversion, envelops the inverted upper end of the cartridge, forms a seal between the retainer plate on the one hand and the cartridge end and ledge 11 on the other. The gas escaping from the cartridge flows into the open space surrounding the punch, from which the extinguishing liquid is excluded, and thence through the passage 9 and pipe 47 toward the inverted bottom of the shell, without mixing with and agitating the liquid in its passage, and presses on the top surface of the liquid, forcing it past the yielding check valve and out through the hose. Opportunity for the gas to be absorbed and dissolved by the liquid is thus reduced to the minimum.

It will be appreciated that the inner wall 7, web 14, and cartridge retainer 28, between which and the cartridge and shoulder 11 there is the liquid seal, as described above, and may be a compressible gasket also, if necessary, form a partition which separates the main chamber of the extinguisher containing the liquid from the chamber or space in which the punch is contained and into which the gas flows from the cartridge in the first instance, preventing the liquid from flowing into this space when the extinguisher is inverted and

preventing gas from leaking into the liquid when the cartridge is punctured. The liquid which, when the extinguisher is inverted, entirely surrounds and submerges the gas cartridge, continues to surround at least what is now the bottom of the cartridge until practically all the liquid has been expelled. And as the cartridge is now at the bottom of the body of liquid, and the outlet is also at the bottom the liquid previously in contact with the cartridge is continually being expelled and replaced by fresh liquid from the upper levels. The expansion of the compressed gas leaving the cartridge lowers its temperature, but the temperature reduction is checked and minimized by absorption of heat from the enveloping liquid and by the constant substitution of warmer liquid for that which is becoming chilled. A most effective transfer of heat from the warm liquid to the expanding gas is thus obtained. Thus it is possible to use liquefied carbon dioxide as the impelling gas, even when the atmospheric temperature is nearly as low as the freezing point of this liquid, without liability of the liquid becoming solidfied and clogging the outlet. A further safeguard against freezing and clogging is afforded by the fact that the gas flows away from the cartridge in passing to the passage 9, and is prevented by the retainer plate from surrounding the cartridge and from displacing the liquid which surrounds the cartridge adjacent to this plate.

In the foregoing description of the structure I have used such terms as "upper" and "lower" for convenience. These terms are to be construed with reference to the upright position of the extinguisher shown in the drawings, except where the context clearly indicates that the inverted position is referred to.

What I claim and desire to secure by Letters Patent is:

1. A fire extinguisher of the type including a cartridge containing compressed gas as the impelling agent, said extinguisher comprising means for making a discharge opening in the cartridge, internal means separating the space wherein extinguishing liquid is contained from the space into which gas is initially discharged, and means for supporting the gas cartridge in the first named space in position to be enveloped by the liquid during discharge of the extinguisher.

2. A fire extinguisher of the type employing an extinguishing liquid and a compressed gas as the agent for expelling the liquid, said extinguisher having means in its normally upper part for supporting a gas cartridge and being invertible for use, means for puncturing the end of said cartridge which is lowermost when inverted, partitioning means separating the space into which gas flows from the cartridge, from the space in which the liquid is contained, said cartridge being in the latter space and surrounded by the liquid when the extinguisher is inverted, and conducting means for leading gas from the former space into the latter space above the inverted body of liquid.

3. In a fire extinguisher of the invertible type employing gas under pressure as the liquid expelling agent, means for holding the gas cartridge in position to be enveloped by the liquid when the extinguisher is inverted, and provisions for conducting the gas liberated from the cartridge, away therefrom and over the upper surface of the inverted body of liquid in a path from which the liquid is excluded.

4. A fire extinguisher comprising a shell, means for supporting a closed gas holding cartridge in the normally upper part of the shell, an inner wall having a supporting shoulder, a retainer plate for said cartridge overlying said shoulder, said inner wall and retainer plate dividing the interior of the shell into a lower chamber for liquid and an upper chamber from which liquid is sustantially excluded, and a conduit leading from said upper chamber toward the opposite extremity of the shell.

5. A fire extinguisher comprising a shell, means for supporting a closed gas holding cartridge in the normally upper part of the shell, an inner wall having a supporting shoulder, a retainer plate for said cartridge overlying said shoulder, said inner wall and retainer plate dividing the interior of the shell into a lower chamber for liquid and an upper chamber from which liquid is substantially excluded, and a conduit leading from said upper chamber toward the opposite extremity of the shell, said retainer having an opening for admission of a perforating punch and for passage of gas liberated from the cartridge, and a punch mounted in the normally upper part of the shell and operable from outside thereof to open a discharge passage from the cartridge.

6. A fire extinguisher of the type employing compressed gas as the expelling agent and adapted to be inverted when in use, said extinguisher comprising a casing having an inner wall in its normally upper part joined to the outer wall of the casing and provided with an external shoulder, separated hangers depending from said shoulder adapted to receive a compressed gas cartridge between them and having cartridge supporting shoulders adjacent to their lower ends, a cover cap removably mounted on the upper end of the casing and having an interior guide sleeve, a cartridge opening punch having a stem mounted movably in said sleeve and protruding therefrom, a retainer plate arranged to bear on said first named shoulder and to overlie the upper end of a gas cartridge supported by the last named shoulders, said plate having an opening for passage of the punch and outflow of gas from the cartridge, and a spring

bearing on said plate and reacting on the cover.

7. A fire extinguisher of the type employing compressed gas as the expelling agent and adapted to be inverted when in use, said extinguisher comprising a casing having an inner wall in its normally upper part joined to the outer wall of the casing and provided with an internal shoulder, separated hangers depending from said shoulder adapted to receive a compressed gas cartridge between them and having cartridge supporting shoulders adjacent to their lower ends, a cover cap removably mounted on the upper end of the casing and having an interior guide sleeve, a cartridge opening punch having a stem mounted movably in said sleeve and protruding therefrom, a retainer plate arranged to bear on said first named shoulder and to overlie the upper end of a gas cartridge supported by the last named shoulders, said plate having an opening for passage of the punch and outflow of gas from the cartridge, a spring bearing on said plate and reacting on said bearing sleeve and connected to the latter, and a ring interposed between the retainer plate and the adjacent end of the spring and secured thereto, said retainer plate having lugs inter-engaged with the ring.

In testimony whereof I have affixed my signature.

ARTHUR C. BADGER.