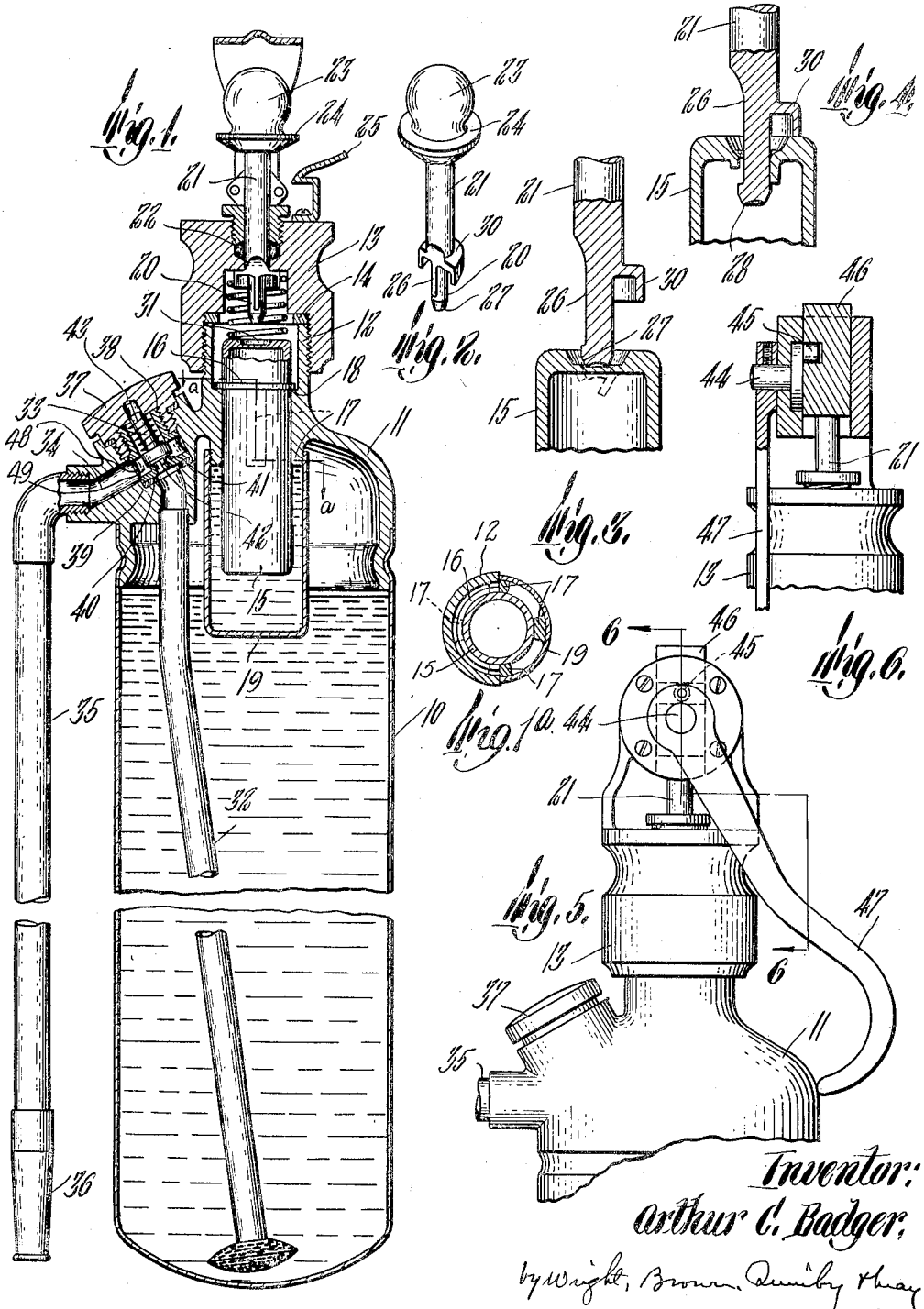
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FIRE EXTINGUISHER

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FIRE EXTINGUISHER.

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This invention relates to fire extinguishers of the type in which the pressure for expelling the liquid contents is furnished by a compressed volatile fluid confined in a closed and sealed holder or cartridge; the fluid being released by puncturing the cartridge and then becoming effective as a gas having substantial pressure to expel the liquid with the desired degree of force. By "compressed volatile fluid" I mean a fluid which is a gas at the atmospheric pressure and temperatures, but may be either in the liquid or gaseous state when confined under high pressure in the holder or cartridge. Extinguishers of this nature are disclosed in prior applications filed by me, and employ as the container for the compressed charge of gas a homogeneous metal shell or envelope having continuous integral and impervious walls surrounding the confined charge. The compressed gas container here referred to is my invention and is claimed in a prior application filed by me on or about the 21st day of October, 1925, Serial No. 64,047.

The charge which I prefer to use as the agent for expelling the fire extinguishing liquid is liquid carbon dioxide, although I may use air or any other gas in the gaseous or liquid state. Heretofore, difficulty has been experienced in controlling the rate of discharge of the compressed gas after puncturing the container, so as, on the one hand, to prevent too rapid liberation of the gas, with the imposition of too heavy an initial pressure on the liquid contents and shell of the extinguisher, and, on the other hand, to maintain a sufficient opening throughout the entire period of discharge of the contents of the gas container. Trouble has also been caused by freezing of part of the compressed charge due to the rapid expansion and consequent chilling of the gas after liberation from the container, the expanded gas when flowing around the container absorbing heat therefrom and causing more or less of the charge remaining in the container to solidify, thus reducing the quantity and pressure of gas available for discharging the liquid, and retarding the escape of the residual portion of the charge until too late to have any useful effect in expelling the liquid.

The object of the present invention is to overcome these difficulties by providing a puncturing means capable of making a discharge outlet of a definite, exact and invariable size, and in such fashion it will not be liable to be choked by bits of the punctured wall punched out or displaced in the course of puncturing; and by providing means for insulating the container from the chilling effect of the expanded liberated gas flowing therefrom. These objects are accomplished by puncturing means and temperature insulating means, of which a preferred embodiment is shown in the accompanying drawings and described in the following specification.

In the drawings referred to,—

Fig. 1 is a longitudinal section of one form of portable fire extinguisher of the type referred to embodying the principles of the present invention; Fig. 1ª is a detail cross section on line *a*—*a* of Fig. 1;

Fig. 2 is a perspective view of the puncturing tool used for opening an outlet in the compressed gas container;

Figs. 3 and 4 are detail sectional views on an enlarged scale illustrating the action of the puncturing tool in opening the container;

Fig. 5 is a fragmentary elevation illustrating a form of the same invention containing different means for operating the puncturing implement;

Fig. 6 is a fragmentary sectional view on line 6—6 of Fig. 5, further illustrating the operating means shown in the preceding figure.

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

The form of extinguisher here shown is one adapted to be used in upright position and capable either of being held in the user's hands when operated, or of being fastened by any suitable fastening means to a supporting structure and equipped with a hose and nozzle for directing the stream as desired. It comprises a shell 10, fabricated in any suitable way of sheet metal or other suitable material, and a head 11 to which the shell is secured in a mechanically strong and leakage-tight manner. This head is formed with a neck 12 externally screw threaded to receive a cover cap 13 which, with an interposed gasket 14, closes the filling opening of the extinguisher and makes a leakage-tight joint therewith.

The body of the extinguisher is filled with

a liquid suitable for putting out fires, which may be water, but is preferably a non-freezing solution or liquid, as, for instance, carbon tetrachloride or a strong water solution of calcium carbonate, in order that the extinguisher may not be rendered useless by exposure to low temperatures. However, plain water may be used if there is no liability of being exposed to freezing temperatures.

The compressed gas container is shown at 15. For convenience of description, I prefer to call this article a cartridge. It is made of a hollow metal body and cover, filled with the preferred gas at the desired pressure, and hermetically closed and sealed after filling by welding the body and cap together, essentially as described in my prior application, Serial No. 692,468, whereby the finished cartridge is provided with a homogeneous, integral, impervious shell completely enveloping the volatile fluid charge. Preferably in the course of welding and uniting the body and cap, I cause these members to be pressed together while soft, with such force that an external rib 16 is formed at the weld; or I may form an equivalent shoulder or collar by other means.

The shoulder 16 serves as means for supporting the gas cartridge in the neck of the extinguisher, which is equipped with a number (preferably four) of inwardly directed lugs 17, the upper ends of which provide seats 18 on which the shoulder 16 rests. The lugs 17 extend below the flaring walls of the head 11 and afford means for attachment of a cup 19, which surrounds the lower part of the cartridge. Preferably, the engaging parts of the lugs and cup are complementally screw threaded, but other means of securing the cup to the lugs may be used.

The means for puncturing the cartridge to release its confined charge is a punch 20 having a shank or stem 21, which passes through a stuffing box 22 in the cover cap 13 through which it is adapted to slide. Its outer end, in the form shown in Figs. 1 and 2, carries a knob or head 23, which may be struck to force the punch inward. Adjacent to the knob is a shoulder 24 adapted to be engaged with a spring latch 25 mounted on the cover cap 13, for preventing expulsion of the punch after it has once passed through the adjacent wall of the cartridge. A different means for advancing and holding the punch is shown in Figs. 5 and 6, and will be later described.

The operative part of the punch is substantially cylindrical, i. e., of uniform transverse dimensions, except the extreme end, which is tapered externally somewhat, but not to a sharp point, at 27. This last item is important, namely, that the end of the punch has substantial area, which may be nearly as great as the full diameter of the punch, but preferably is a little less. The end face of the punch is slightly recessed, as shown in Figs. 3 and 4, in order to provide a distinct annular edge 28 the major part of which is a cutting edge sharp enough to sever cleanly the opposed wall of the cartridge and make a hole therein of the same outline as the edge 28. A limited portion of the edge 28 at one side of the punch is dull to insure that the punching cut out of the cartridge will remain attached at one side of the hole. One side of the punch is cut back or recessed, above the tapered extremity, as indicated at 26, for a sufficient distance from the end of the punch and far enough inward from the continuation of the periphery of the punch, to leave an opening between the rim of the hole formed in the cartridge and that part of the punch which occupies the hole, of exactly the right size to permit discharge of the contents of the cartridge at the prescribed rate. On the stem of this punch is formed a stop rib 30 designed to limit the penetration of the punch into the cartridge, when a sharp blow is struck on the external knob, by coming in contact with the cartridge. When, or somewhat before, the punch has penetrated as far as permitted by the stop 30, the shoulder 24 passes by the latch 25 so as to become interlocked therewith.

The wall of the cartridge next to the punch is preferably made thinner than elsewhere in an area at 31, somewhat larger than the diameter of the punch, but smaller than the stop 30, in order that the punch may pass through this wall when impelled by such a force as can be feasibly applied in the conditions of use, and without otherwise distorting or breaking the shell of the cartridge.

It will be readily appreciated that when the punch is forced inward, its advancing edge partially severs a disc from the wall of the cartridge which is opposed to it. This disc remains attached to the wall at one side and is bent back by the advancing punch. Its attachment prevents it from being impelled by the outflowing stream into a position where it would block the escape opening. The punch cuts a clean hole in the cartridge and as it advances, its tapered surface 27 bends in the rim of the hole and enlarges it, at the same time causing the sides of the punch to make close contact with the rim of the hole at all points except that where the recessed area 26 is located. Thus the only outlet left for discharge of the gas is that bounded by the recessed area and the portion of the rim of the hole which crosses the recess. The size of this opening may be made of any value desired, so that an exact regulation of the pressure applied to expel

the extinguishing liquid is afforded, and danger of exerting an excessive initial pressure is avoided, the supply of pressure gas is conserved so as to continue exertion of a substantial pressure on the liquid until it is all exhausted, and the liquid is discharged from the extinguisher with the force which will throw it to the desired distance.

The construction of the punch according to the principles described insures that, when it penetrates the cartridge wall, it will be closely embraced by the rim of the hole through which it passes and that the opening left for escape of gas will be of exactly the predetermined size. The punch does not crack, split or tear the cartridge, as a sharp pointed conical punch is liable to do, and so never makes an unexpectedly large escape opening. But by reason of the slight taper at its end, and the uniform cross section back from the end, of that part of the punch which passes through the hole, it makes so tight an engagement with the walls of the hole that no appreciable amount of gas can leak past at any point except where the punch is intentionally recessed for the purpose of leaving an escape opening.

The gas escaping from the cartridge flows around the outside of the cartridge through the spaces between the lugs 17 into the main body of the extinguisher, as it is free to do through the space between the sides and shoulder 16 of the cartridge and the surrounding walls of the neck 12, and presses on the top surface of the liquid therein. As it expands, it becomes chilled. In order to prevent the chilling effect from solidifying the remnant of the charge, I have provided the cup 19. This cup is located directly under the mouth of the extinguisher through which the extinguishing liquid is put in when the cover cap 13 is removed, hence when such liquid is poured in, it fills the cup and overflows into the body of the extinguisher. It remains in the cup, enveloping the lower part of the cartridge, and insulating the latter against the chilling effect of the expanded gas.

The liquid in the extinguisher is expelled through a pipe 32 running from the bottom of the extinguisher to the head, and passes a spring closed valve 33, provided to prevent loss of the liquid by evaporation, and flows thence through a passage 34 in the head to a flexible discharge hose 35 having a nozzle 36.

The valve 33 is mounted in a detachable casing consisting of two separable parts, an outer part 37 and an inner part 38, screw threaded together. This casing is screwed into a chamber formed in the head crossing the passage 34, and its inner part is pressed against a gasket 39 resting on a shoulder 40 in the head. The inner part is provided with a valve seat 41 against which a washer 42 on the valve is pressed by a spring 43 bearing on the valve and reacting against the outer part of the casing. The inner part of the casing has lateral ports 48 and an external groove 49 through which the liquid may flow to the passage 34.

The same puncturing means may be applied to extinguishers of other forms and sizes, including those which are inverted when put in use.

The modification illustrated in Figs. 5 and 6 relates to means for advancing the punch. In this case, a shaft 44 is mounted in a bearing supported from the cover cap 13 and carries an eccentric pin 45, or equivalent member, occupying a transverse slot in a block or head 46 connected to or bearing on the stem of the punch. A handle 47 is secured to shaft 44 and serves as means for rotating the shaft and thereby applying force through the eccentric pin to drive the punch inward through the wall of the cartridge. The punch used in this case is otherwise the same as that previously described, and in other respects also the extinguisher is, or may be, identical with that described.

The gas upon liberation from the cartridge is above the liquid in the extinguisher and is thus able to apply its pressure to the surface of the liquid without first passing through it. In this way contact between the gas and liquid is limited to the top surface of the body of liquid and absorption of gas is of the minimum.

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

1. In an apparatus including a cartridge having a confined volatile fluid charge under compression, means for releasing such charge with control of the rate of discharge thereof comprising a punch having an imperforate cutting end of substantial area adapted to cut through the wall of said cartridge and partially sever a disk from such wall, and having a portion adjacent to its end adapted to expand the hole so made, the punch having a recess in one side adjacent to its cutting end.

2. In an apparatus employing a cartridge having a continuous envelope confining a compressed charge of volatile fluid, means for releasing such fluid with control of the rate of discharge thereof comprising a punch adapted to be forced through a wall of said cartridge and formed to displace a punching therefrom, said punch being also provided with a wedge portion at its end, and having a recess of determined area in one side adjacent to said wedge portion.

3. A fire extinguisher comprising a shell containing a liquid charge, a cartridge mounted in said shell having a continuous envelope enclosing a compressed charge of volatile fluid, and a punch mounted in the extinguisher in position to be forced through

a wall of the cartridge, said punch having a cutting end of substantial area, a spreading portion adjacent to such cutting end, and a portion of uniform transverse dimensions from said spreading portion, having a recess of determined area in one side arranged to extend across the rim of the hole made by the punch in penetrating the cartridge wall.

4. A fire extinguisher comprising a shell adapted to contain liquid and including a head with a filling opening, a cartridge comprising enveloping walls enclosing a compressed charge of volatile fluid, means for supporting such cartridge in the head of the extinguisher, a cup mounted in the extinguisher enveloping said cartridge in position to receive liquid poured into said filling opening and adapted to hold such liquid, and means for puncturing the cartridge to permit release of its confined volatile charge.

5. A fire extinguisher comprising a shell adapted to contain liquid and including a head with a filling opening, a cartridge comprising enveloping walls enclosing a compressed charge of volatile fluid, means for supporting such cartridge in the head of the extinguisher, a cup mounted in the extinguisher, in position to receive, and constructed to hold, liquid poured into said filling opening, enveloping the lower part of the cartridge, and a punch arranged to puncture the upper end of the cartridge.

6. A fire extinguisher comprising a shell adapted to contain liquid and including a head with a filling opening, a cartridge comprising enveloping walls enclosing a compressed charge of volatile fluid, means for supporting such cartridge in the head of the extinguisher, a cup mounted in the extinguisher in position to receive, and constructed to hold, liquid poured through such filling opening, enveloping the lower part of the cartridge, and a punch arranged to puncture the upper end of the cartridge, said punch having a cutting end of substantial transverse area adapted to sever, at least in part, an area from the adjacent walls of the cartridge, and an expanding portion adjacent to such end adapted to pass through the hole so formed, crowding the rim of the hole into tight engagement with the sides of the punch; that part of the punch which then crosses the said wall of the cartridge having a recess to provide a passage for the contents of the cartridge.

7. In a fire extinguisher containing a charge of extinguishing liquid, a closed cartridge confining a highly compressed volatile fluid, means for puncturing the cartridge to release the compressed contents thereof, and means adapted to contain a quantity of the extinguishing liquid surrounding and in contact with the cartridge.

8. In a fire extinguisher containing a charge of extinguishing liquid and having a closed cartridge confining a highly compressed volatile fluid, means for puncturing the cartridge to release the compressed contents thereof, and means for insulating the cartridge against the chilling effect of the expanded fluid so released, said insulating means comprising a cup containing a quantity of the liquid contents of the extinguisher surrounding the cartridge.

9. In a fire extinguisher having a closed cartridge containing a compressed volatile fluid charge, a punch for making an opening in said cartridge to release the contents thereof, said punch being of solid, imperforate construction and having an edge at one end forming a closed outline, the major part of which is a cutting edge adapted to sever the material of the cartridge, while the balance is relatively so dull as to leave an integral union between the cartridge shell and that part of the shell which is cut out by the punch; that part of the punch which then crosses the punctured wall of the cartridge having a side separated from the adjacent side of the hole to provide a passage for the contents of the cartridge.

10. A fire extinguisher having a cartridge containing a charge of compressed volatile fluid, a punch for opening such cartridge to release the contents thereof, said punch having an edge at one end forming a closed outline, which edge is of cutting character throughout all but a minor portion of its extent, and having an enlarging taper from the cutting edge, the part of the punch adjacent to said taper being cylindrical and having a flattened portion at one side.

11. In an apparatus employing a cartridge having a continuous envelope confining a compressed charge of volatile fluid, means for releasing such fluid with control of the rate of discharge thereof comprising a punch having a portion adapted to be forced through the wall of such cartridge and formed with uniform transverse dimensions throughout its operative length, except at its extremity, where it is tapered to an imperforate end face of slightly smaller dimensions, the edges of which are adapted to displace a punching from said wall, the transverse outline of the punch back from the tapered zone thereof being similar in outline to said end face, except at one side, such side being recessed.

In testimony whereof I have affixed my signature.

ARTHUR C. BADGER.